

DEAF - FIRST ARCHITECTURE

AN EDUCATIONAL DESIGN FRAMEWORK FOR DEAF AND HARD OF HEARING

Travis Hauan

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Committee:
Robert Peña
Richard Mohler

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Chair of the Supervisory Committee:
Associate Professor Robert B. Peña,
Department of Architecture

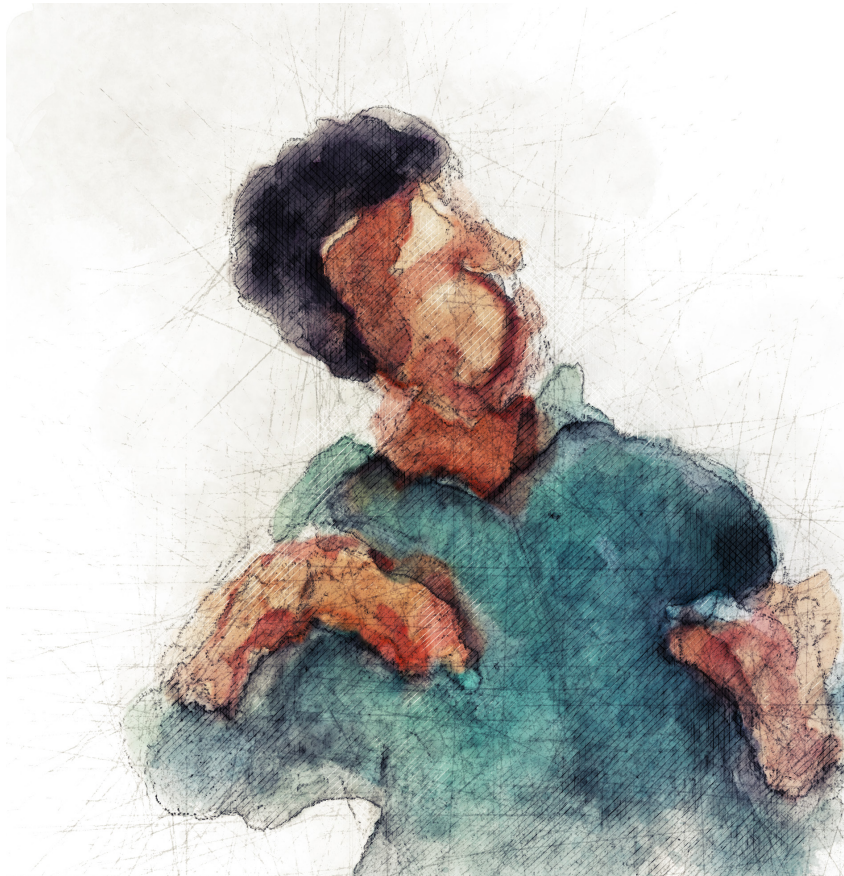
ABSTRACT

The Deaf culture is one of, if not the only, people group with a culture and language that does not have a recognized building vernacular. Architecture has yet to respond to the needs of the deaf in a meaningful way. This thesis was built from over a dozen interviews with members of Deaf culture, instructors and students of deaf education.

In exploring modified space, a framework emerged that can inform the designer of priorities and strategies when designing for the deaf. These principals were applied to a new pre-k - 12th grade day school for the deaf located in Seattle's Capitol Hill neighborhood. In approaching school design for the deaf student first, a vernacular emerges that evokes high quality spaces that benefits all students.

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CHAPTER I

INTRODUCTION

I was politely yanked to the side by a passing stranger as myself and a teacher at Atlanta School for the Deaf ambled down a hallway conversing about the new building remodel. The motion prevented me from walking directly into a column splitting two doors. The teacher I was conversing with is deaf, and we were signing in American Sign Language (ASL). I hadn't seen the architectural faux pas quietly lurking in the center of the busy hallway. While there are many examples of architecture failing to meet the needs of the people it was designed for, this was my first experience seeing architecture brandishing its ignorance for the people who inhabited this space.

The Deaf culture is one of, if not the only, people group with a culture and language that does not have a building vernacular. Architecture has yet to respond to the needs of the deaf in a meaningful way. Being deaf, for many individuals, isn't the loss of a sense as it is the identity marker of a proud culture. Architecture provides a unique opportunity to

embody values and to be shaped by the people who inhabit it. Across the United States from Washington D.C. to California, deaf communities tend to populate around access to education. Traditionally, before the internet and access to mass communication these were the places to meet other deaf individuals. This still remains true today. In establishing a vernacular for deaf architecture, schools are the best place to start. Winston Churchill stated, "We shape our buildings; thereafter they shape us"¹. In exploring the needs and desires of the deaf community, a new type of architecture can emerge that does not simply accommodate deaf individuals, but puts deaf needs first.

This thesis was built from extensive research and over a dozen interviews at 5 different schools for the deaf and blind with

1 UK Parliament. (2017, March 2). Retrieved from Churchill and the Commons Chamber: <http://www.parliament.uk/about/living-heritage/building/palace/architecture/palacestructure/churchill/>

deaf educators, students and various other members of Deaf culture. The result is a design framework for primary and secondary school architecture by focusing on the deaf student first and founding a deaf-specific building vernacular through a multi-sensory design approach. This approach to educational spaces will not only seek to meet and elevate the needs of Deaf culture, but provide higher quality learning environments for all students.

Deaf individuals inhabit different sensory worlds than hearing individuals. In fact, many factors that establish strong design principals for deaf students are beginning to emerge in contemporary school architecture (wider multi-use hallways, better lighting, acoustic treatments etc.) In understanding the needs of the Deaf community, and engaging a multi-sensory design approach, newly designed educational spaces will help to preserve a culture, cement an identity and benefit students from all backgrounds.

In order to fully explore the potential of a deaf-first approach, this thesis proposes

a new mixed pre-kindergarten - 12th grade school designed for the deaf which will serve deaf, deaf-blind and hearing students in downtown Seattle. The creation of an urban day school provides a unique opportunity to function as a beacon and hub for both the deaf and hearing communities in the greater Seattle area. The principals and conclusions made throughout this thesis regarding the needs of the deaf community will define the program, allowing the form and tectonics to mirror the priorities of the Deaf community. The insertion of a deaf-focused space of urban infrastructure will help promote a vital bridge between hearing and deaf communities, establishing the framework for meaningful interactions and a memorable urban experience.

CHAPTER II

DEAF CULTURE, COMMUNITY AND COMMUNICATION

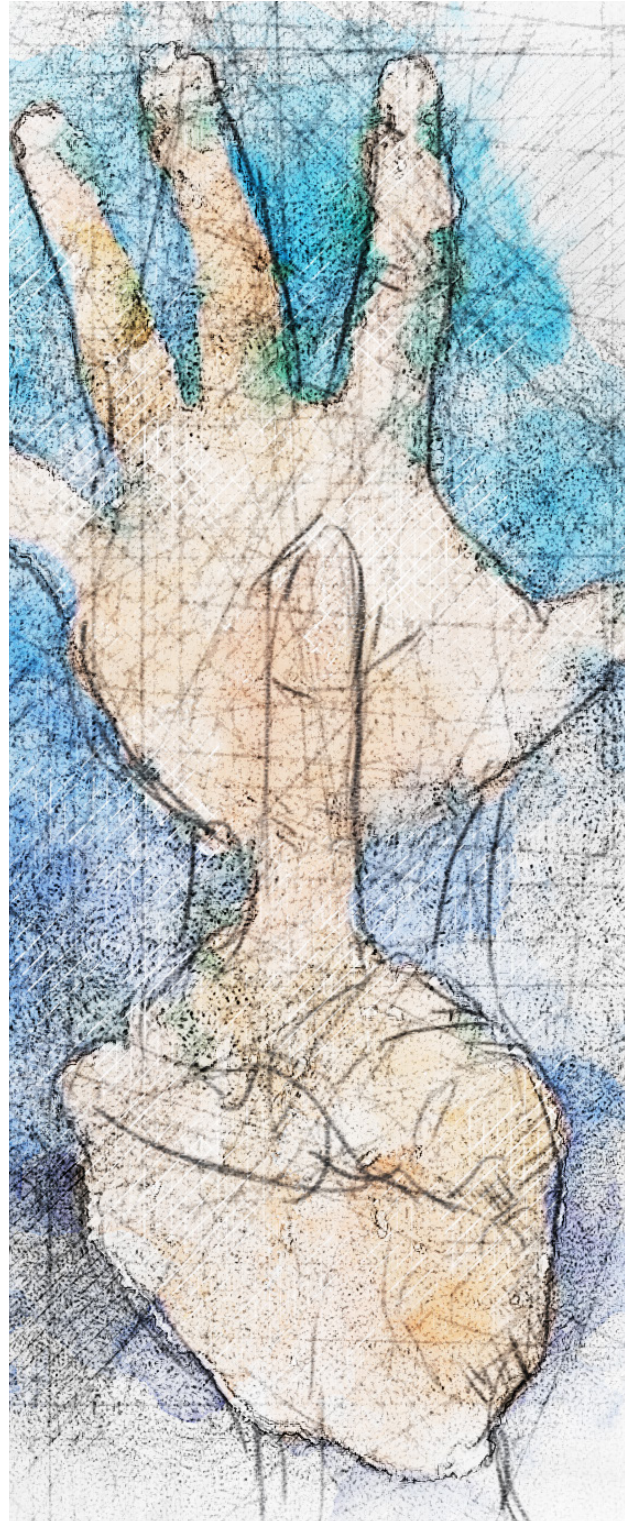


Fig. 1 - ASL reading: Deaf Culture Shine

Culture is a set of shared values, practices, conventions, and attitudes¹. Culture is built through interaction and reinforced as individuals with shared experiences connect and continue to establish their values, customs and attitudes. Usually these sets of values and attitudes are passed down from parents to their children. However, 90% of deaf children are born to two hearing parents that have no knowledge of Deaf culture². Most parents do not know American Sign Language (ASL), a primary means and often the first language of many deaf individuals. This often sets up early language delays for children which can have a profound impact throughout their life. Communication barriers or even a total lack of communication with the world is often a shared experience among many deaf individuals.

Perceptions on deafness and hearing

loss differ greatly. Webster's dictionary, for example, identifies deafness as "lacking or deficient in the sense of hearing; not being able to hear"³. This definition however, implies that being deaf is a medical condition that should be cured. This is a common perception for much of the hearing community⁴. Western medical models tend to focus on curing an illness that deviates from the norm. The hearing parent who finds out their child is deaf will likely receive advice first from their medical provider that the most effective option is to intervene in order to correct hearing loss⁵.

For many deaf individuals however, being deaf isn't the loss of a sense rather it is the identity marker of a proud culture. The Deaf do not believe themselves to be disabled and do not see the world as a disabled person might. For example, a disabled person may not wish for their children to have their

1 Merriam-Webster Dictionary.
<http://www.merriam-webster.com>

2 Karchmer, R. E. (2002). Chasing the Mythical Ten Percent: Parental Hearing Status of Deaf and Hard of Hearing Students in the United States.

3 Merriam-Webster Dictionary

4 Lane H. Ethnicity, ethics, and the deaf-world. *J Deaf Stud Deaf Educ.* 2005;10(3):291-310

5,7 Lane, Ethnicity, ethics, and the deaf-world. 291-310

disability. However, deaf parents often hope for their children to be deaf, but are content if they are born hearing. The deaf community is accepting and welcoming to hearing individuals⁶. Spouses, family members, friends and children of deaf adults (CODA) have a special place within the deaf community and bring unique perspectives of their varied experiences with the hearing and deaf worlds.

The deaf community is different than Deaf culture. The deaf community is made up of both hearing and deaf individuals with varying degrees of hearing loss. These hearing individuals may be siblings of deaf individuals, ASL interpreters, spouses, friends etc. that interact with the greater deaf community and each identifying themselves differently. When referring to the Deaf culture, an uppercase “D” is used on the word Deaf to indicate Deaf culture; a lowercase “d” in “deaf” is used to indicate the medical condition of hearing loss⁷. This is an important distinction

to understand. A person may be deaf but identify with hearing culture. This is more common with individuals who may have hearing loss later in life and have become deaf after acquiring English as their first language, seeing their hearing loss as medical. However, individuals who identify with the Deaf culture share traditions, values, beliefs, attitudes and a language.

Within the United States American Sign Language (ASL) remains the primary means of communication among deaf individuals and is also a significant cultural symbol. Understanding ASL’s role in shaping and organizing the deaf community in the United States is essential to discern the cultural and spatial considerations of communicating visually.

ASL: A BRIEF HISTORY

Laurent Clerc introduced French Sign Language (LSF) to the United States beginning in 1817. ASL today is strongly influenced by French Sign Language and

7 Eckert RC. 2010;15 Toward a theory of deaf ethnoscience: deafnicity — D/deaf. p.317–333

carries with it a similar grammar and lexicon. According to Emily Shaw and Yves Delaporte, contemporary ASL historians, they admit that much is unknown about the early years when ASL began to crystallize and particularly how Gallaudet, the first deaf American university located in Washington D.C., communicated with their existing students⁸. Shaw and Delaporte also posit that during ASL's nascent years there were a very diverse set of students at Gallaudet; some of these students were older, some had never used a sign language before, some came from deaf families (where they were already signing), and many were children from Martha's Vineyard, where a long-established sign language was already in use⁹. The diversity of people who sign and use other methods of communication have followed the deaf community since the very beginning.

8 Shaw, Emily, and Yves Delaporte. Winter 2011. "New Perspectives on the History of American Sign Language." *Sign Language Studies*; p. 158-204.

9 Shaw et. al., *New Perspectives on the History of American Sign Language*; p. 158-204.

ASL became recognized as an official foreign language accepted at universities in 2004 with the Education Reform and Funding Act "No Child Left Behind"¹⁰. There has also been a lot of recent interest in parents using baby sign language with infants to aid in early communication. ASL is a fascinating language that provides equal speed of communication to its spoken language counterparts. By providing access to ASL education, deaf and hearing individuals can gain access to a vibrant and exciting community, woven into the fabric of American culture.

LISTENING, SPEAKING AND TECHNOLOGY

While ASL exists as the backbone for communication and pride among Deaf culture, alternative methods for teaching deaf children to communicate also exist. These methods are called listening-spoken educational models.

10 Americans with Disabilities Act. <http://www.ada.gov>; Lieu CC, Sadler GR, Fullerton JT, Stohlmann PD. 2007 Communication strategies for nurses interacting with patients who are deaf.; p. 541–551



Fig. 2 - Dad with tattoo to match daughter's cochlear implant

Listening-spoken methods are based on the assumption that deaf children can learn to listen (lip-read) and speak, allowing the child to integrate into the hearing community. In this case, families don't have to learn sign language. Lip reading effectiveness however, varies dramatically between the users' skill and conditions. Many sounds look similar and obstructions such as facial hair or someone's hand can often impede comprehension. Lip reading on average yields around 30-40%

comprehension under the best conditions¹¹.

With the advancement of technology, particularly cochlear implants and sophisticated hearing aids, a form of hearing is often available for individuals with hearing loss or inner ear damage. A cochlear implant however, does not take away someone's hearing loss; it merely offers an electronic

11 Bat-Chava Y, Martin D, Kosciw JG. Barriers to HIV/AIDS knowledge and prevention among deaf and hard of hearing people. *AIDS Care*. 2005;17(5):623-634.

method of sending digital audio signals directly to the inner ear to create a form of hearing. Parents of deaf children who pursue this route rarely have their child take up ASL as a first language and will merely try to integrate their child into hearing culture with assistance.

In addition to the inherent medical risks of cochlear implant surgery, parents waiting for their child to undergo this surgery provide little to no language input until after the surgery is complete. At the earliest, cochlear implant surgery can happen within 12-15 months of a child's life. Each case is different and sometimes a child must wait years before the surgery can be performed. The first few years of a child's life are critical for brain and linguistic development.

LEAD-K is a campaign run by members of the Deaf culture who's focus is to help all deaf babies to become kindergarten ready by the age of 5¹². This is

done by providing them with early access to language; namely, ASL. The foundation of their message is based off of contemporary studies in medicine, psychiatry and language acquisition which show how vital it is for children to acquire any kind of language early.

Dr. Sanjay Gulati, a psychiatric professor at the Harvard School of Medicine affirms that language is not related to sound. In fact, "children learn sign languages early, as they do spoken ones, with a nearly complete comprehension of grammar by age three. Those not exposed to usable language by the age of four will never learn any language fluently. And a child with no exposure by seven or eight will acquire a form of mental retardation."¹³. The evidence of children acquiring sign languages early is further established by the work of Laura-ann Petitto, a neuroscientist and psychologist at McGill University in Montreal. Petitto discovered that deaf babies of deaf parents will babble

12 LEAD-K. 2017. Language Equality & Acquisition for Deaf Kids. May. Accessed May 21, 2017. <http://www.lead-k.org/>

13 Gulati, Sanjay. 2015. "The Sounds of Silence." Harvard Medical Journal.



Fig. 3 - Toddler signing with teacher



Fig. 4 - Using tactile-sign to communicate

with their hands in a meaningful way as hearing babies do when imitating their mother tongue¹⁴. The implication is that early access to any language, whether visual or aural, is vital for child development.

DEAF-BLIND

Important and sometimes overlooked members of the deaf community are the deaf-blind. Deaf-blind is not a deaf person who cannot see or a blind person who cannot hear; the deaf-blind individual is multi-sensory deprived (MSD) which prevents them from using their senses of vision and hearing to receive non-distorted information¹⁵. The degree of hearing loss or vision loss can vary greatly among those who are MSD.

A child who is deaf-blind is welcomed into Deaf culture and will receive education that incorporates adapted input from blind

education as well as deaf education. For the MSD child, ignoring the condition and pursuing medical intervention is less of an option than it might be for children who have only hearing loss. The MSD child will require parents to be able to adapt to their particular needs and to adjust their communication style accordingly. Failing to do so will result in prolonged language acquisition and will further harm the child's emotional and mental development¹⁶. While the challenges of communication are more difficult with deaf-blind children, the benefits of early language acquisition and emotional bonding remain the same.

14 Gulati, Sanjay. 2015. "The Sounds of Silence." Harvard Medical Journal.

15 McInnes, J.M., and J.A. Treffry. 2005. Deaf-Blind Infants and Children: A Developmental Guide. Toronto: University of Toronto Press.; pp.2

16 Ibid.; pp. 4

CHAPTER III

DEAF IN EDUCATION



Fig. 5 - Why deaf education?

Deaf education is unique among minority learning groups within the U.S. education system in that deaf students have an additional culture and a different native language, ASL. In contrast, blind students for example, require additional resources to aid with the learning progress; however, blind students remain in the majority culture and communicate with the majority language, English. For education professionals, there are many advantages to focusing on the deaf student in order to create a better learning environment for all. This sensitivity to educational and physical needs begins to establish a necessary framework to inform both designers and educators.

An analogy used by Georgia's Pathway to Language and Literacy organization, a program that advocates for early language acquisition for deaf and hard of hearing students, is the analogy of the canary in the coal mine. In this case, if the deaf student succeeds all other students will succeed. For the deaf child, the most significant barriers in education center around the acquisition of language and the ability to communicate. This manifests itself into four key milestone markers, identified at four stages in primary through secondary education. These include:

1. Birth - kindergarten
2. Kindergarten - 3rd grade



Fig. 6 - Deaf education key milestones.

3. 4th grade - 8th grade
4. High school and beyond

NEEDS PRE-K

As previously mentioned, all children need early access to quality language. Critical stages of language happen as soon as, or even before the child is born. Author, professor and infant mental health specialist Douglas Davies posits,

From the first birthday to 18 months, the toddler's language acquisition proceeds gradually. Then, at about 18 months, the child's wish to communicate in language takes on new urgency. Language development seems to be driven by an inherent 'urge to convey' one's thoughts, as well as by the toddler's awareness that language is a social tool.¹

For many deaf children this critical period of language development is often skipped, particularly if both parents are hearing and

the child has no access to ASL. What people who are not deaf often tend to overlook is the importance of focused and varied communication required for deaf children. For the deaf student, hearsay and passive learning is more difficult simply because the child has to be looking and paying attention to the speaker to receive any input at all. During an announcement in 2015, the commissioner of public health in the state of Georgia, Dr. Brenda Fitzgerald, declared a public health emergency for deaf children not receiving adequate access to language². School environments offer an opportunity to provide children and their parents the tools to communicate quicker and more effectively through ASL. This visual method of communication could not only benefit deaf children but hearing children as well. Imagine being able to communicate with your baby, if they are hearing or deaf, before

¹ Davies, Douglas. 2006. *Child development : a practitioner's guide*. Guilford Publications, Inc.; pp 143

² Fitzgerald, Brenda. 2017. "EARLY HEARING DETECTION & INTERVENTION." *Georgia Pathway to Language and Literacy for Children Who Are Deaf/Hard of Hearing* . February 27.

they are able to pronounce comprehensible sounds. In addition the ability to create extrinsic motivators for learning language (the ability to speak with your baby earlier) could be a powerful incentive for parents with deaf or hearing children to learn ASL as a second language. Providing language access, any language access, to babies in order to prepare them for entrance to school will not only help them profoundly in the near future but also further down the road as well. This early access to complete language provides the platform required to meet the next major academic milestone; literacy.

NEEDS K-3

As children enter school, language development should be well on its way and they should be ready for a wider array of needed input. For the deaf child, the next major milestone is to reach grade level language literacy by the third-grade or early fourth-grade. Literacy aptitude by third-

grade is a key indicator of future academic success later in life³.

In addition, Children at this age require educators and their facilities to be able to provide the right environment to meet students' academic, physical, social and emotional needs. For the school, it is a challenge to be able to group younger students with older students. In fact, in some cases this may increase the risk of bullying or inadvertent abuse. This requires special care to be taken by the educational staff to carefully orchestrate the grouping of students into corresponding age groups. For children at this age, it is vital that there is access to areas of safe physical activity. Dedicated indoor and outdoor play areas are vital for student wellbeing and health.⁴

3 Ibid.

4 Parker-Pope, Tara. 2008. "Natural Settings Help Brain Fatigue." New York Times. October 27. <http://well.blogs.ntimes.com/2008/10/27/natural-settings-help-brain-fatigue>.

NEEDS 4-8

At this stage if deaf or Deaf and hard of hearing (d/Dhh) children have successfully reached the previous linguistic milestones, the child will have successfully built a complete language, acquired the ability to read and can now read to learn⁵. The goals in this stage of learning are to provide the student with access to high level language; this can come from adults, peers or through the use of technology. Additionally, the student must also be progressing along the expected route of academic performance in preparation for high school.

NEEDS 9-12

By the beginning of high school, students should have a full and complete language with strong literacy skills. This will

allow students to enter into high academic rigor with the skills and tools needed to succeed for post high school studies. High school students are introduced to more levels of freedom as they grow older and prepare for post high school life. For the deaf student, this is a key stage where the student must be able to successfully navigate the hearing world in order to adapt to changes in the environment and access to communication with those who do not sign. Nearing the end of secondary education, students' ability to read, write and communicate at a high academic level is needed to move to the next level of academic rigor. If key milestones have been met throughout the d/Dhh child's education, it is more likely they will succeed in post secondary studies⁶. The communication difficulty that many d/Dhh students face however, goes beyond regular difficulties that hearing students face during this time in their education (academic performance, social

5 Fitzgerald, Brenda. 2017. Georgia Pathway to Language and Literacy for Children Who Are Deaf/Hard of Hearing

6 Ibid.

development, emotional intelligence, etc.). This challenge however, can be minimized through careful education in which integration with both the Deaf culture and the hearing community through English and ASL is established early and continues throughout their education. With these key milestones listed, it becomes easier for educators to begin to contemplate the use of space in order to assist for students reaching these milestones. Hearing students, in many cases, struggle to meet these milestones and by focusing on the deaf student first, the benefit for all students begins to emerge in a tangible way.

SPATIAL INTEGRATION

Architecture presents an opportunity to pair with the needs and desires of Deaf culture and D/dhh educators. Careful planning of spaces that focus strategically on boosting the ability to communicate provide many benefits for all students. These strategies are also beginning to emerge as trends in

contemporary teaching philosophy that aim to break down the scale, encourage collaboration and create more sustainable and safer spaces. The following chapter will examine the history of the traditional school model and unpack current trends in educational architecture as the landscape of education shifts from a teacher-focused model to a learner-focused environment.

CHAPTER III

THE 21ST CENTURY SCHOOL



Fig. 7 - The 21st century school

A BRIEF HISTORY OF SCHOOLS

Between 1852 and 1917, the United States implemented compulsory schooling. This change required a new way of managing more students as education itself flattened to incorporate larger populations of children that previously couldn't attend school. Spatially this created a challenge in order to manage and organize these larger groups of students. Rural communities often manifested themselves into one-room school houses which was eventually succeeded by the factory school model, still most commonly seen today¹.

In the early 20th century the typical school model, which is commonly referred to as the "Ford Educational Model", or the "Factory Model," was based off of the assumption that a predetermined number of students will all learn the same thing at the same time from the same person in the same

way in the same place for several hours each day. The term "Factory Model" was coined because of its similarity to the process of a factory where a high volume of product is exported, using the same methods repeated to increase efficiency. Spatially, this educational philosophy manifested itself into 800ft² rooms that holds roughly 20-30 students with arm chair desks, a teacher's desk and a black or white board at the front.

While there have been variations and some evolution on this model, entering the 21st century the philosophical foundation of this teaching method still remains the same. Even though building technologies may have increased, newly designed schools are often fundamentally the same as the factory model. Changing the traditional school's spatial organization to respond meaningfully to advancements in educational philosophy and teaching trends has proven more difficult than assumed. Sadly, failures to innovate the traditional school model have stunted progress towards a greatly needed change. The

1 Gerver, Richard. 2009. *Creating Tomorrow's Schools Today: Education - Our Children - Their Futures*. London: Continuum International Publishing Group.

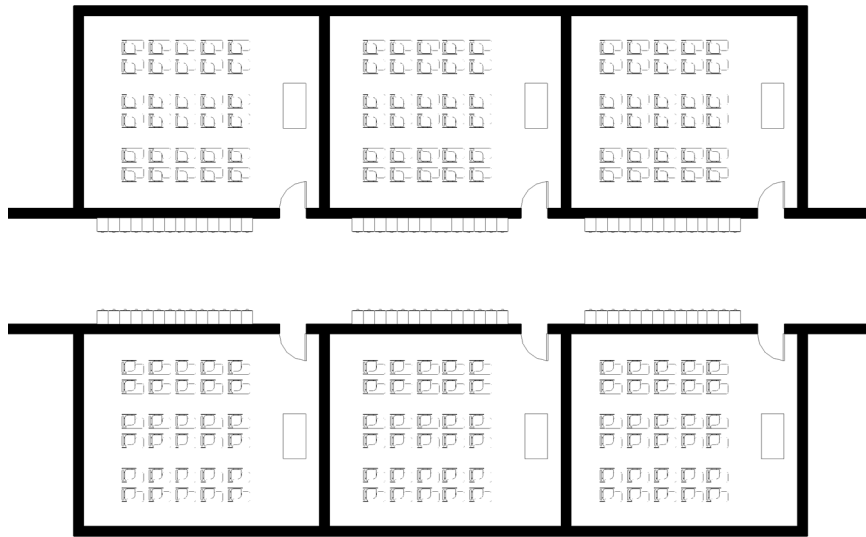


Fig. 8 - Typical space arrangement for the the Ford Model, the Factory Model or "Cells & Bells"

most commonly known failure is the open-classroom school movement.

OPEN-CLASSROOM SCHOOLS

The open-classroom school originated in the United Kingdom and migrated to the United States in the late 1960s. The assumption was that by removing the classroom walls collaboration could occur between classes, increasing connection between teachers and students². This was a step away from the traditional teacher-centered educational model towards a learner-centered model. This new type of school architecture

was short lived, coming to a frustrated demise in the late 1970s. The open-classroom school promised to activate the learner, allowing students to learn however they wanted. The idea was to move a teacher-centered model of education to a multi-usage, student-centered model. The architecture built at this time did away with solid walls in favor of thin partitioned walls, or large open rooms. Up to 200 students could be brought into these larger rooms governed by several teachers and were able to access subjects based on their interest and ability³.

The open-classroom school failed for

2 Gerver, *Creating Tomorrow's Schools Today: Education - Our Children - Their Futures*, pp. 18

3 Cuban, Larry. 2004. "The Open Classroom." *Education Next*. May. Accessed May 14, 2017. <http://educationnext.org/theopenclassroom/>.

two fundamental reasons. The most evident reason is that teachers did not practice this philosophy of education. Teachers would attempt to run traditional classes in open rooms which often resulted in chaos. Schools that were built for the open-classroom soon put up walls, resulting in awkward spatial arrangements that mimicked the traditional school mode. The second reason is that the design of the school itself suffered from fundamental flaws in building technology and spatial arrangement. These rooms often have little in the way of acoustic treatment, placement of quiet zones, varying furniture or zone segregation. The result was often distracted students and frustrated teachers. It is no wonder that this movement was vehemently dismissed in the late 1970s and only serves as a painful reminder to educators today of how bad deviation from the traditional classroom model can be⁴.

TOWARDS A NEW SCHOOL MODEL

Technology has presented a new imperative for educators to rethink its role in learning, use and structure in education. It is becoming evident that the way we access technology in the workplace and our daily lives demands education to adapt to the growing need for a newer way of teaching and learning. Teachers are finding their role shifting from a distributor of information to a facilitator. 21st century schools have the opportunity to adjust their physical makeup to adapt to these rapidly changing circumstances in order to help prepare students for a different kind of world; one that integrates abundant access of knowledge through technology that is further integrating itself into our everyday lives.

THE LEARNING ENVIRONMENT

Today there are two competing models of education: Teacher-centered learning and

4 Cuban, "The Open Classroom."

Student-centered learning⁵. Teacher-centered learning is traditionally how we've organized schools. The teacher stands at the front of the classroom and distributes knowledge to students. "Student-centered learning is a philosophy of education that centers on the student as an active participant in learning. Under this paradigm, every student in school is a worker and the teacher becomes a facilitator."⁶ In the past two decades a student-centered learning approach has been gaining a great deal of momentum. According to Prakash Nair, president and founding partner of Fielding Nair International - an award-winning school planning and architectural firm based out of New York, student centered learning has gained traction because it is backed by strong research and that the knowledge and competencies for success in the twenty-first century are vastly different

than those of the twentieth century⁷. Research affirms the argument that students acquire deeper understanding when they engage directly in the activity.

A student-centered model provides more value and opportunities for deep understanding when compared to rote memorization. The true value of this model however, lies in its ability to be personalized for each student⁸. In the previous chapter it was mentioned that for the deaf student, the importance of direct and deliberate communication is required to meet key academic milestones. With a student-centered model these goals become easier to achieve and provide significant value to not only deaf or deaf-blind students, but to each student individually and all students collectively.

5 Nair, Prakash. 2014. *Blueprint for Tomorrow: Redesigning Schools for Student-Centered Learning*. Harvard Education Press; pp. 31

6 Nair; *Blueprint for Tomorrow: Redesigning Schools for Student-Centered Learning*; pp. 31

7 Ananiadou, Katerina, and Magdalen Claro. 2009. *21st Century Skills and Competences for New Millennium Learners in OECD Countries*. Working Paper, OECD Publishing ; pp. 12

8 Nair; *Blueprint for Tomorrow: Redesigning Schools for Student-Centered Learning*; pp. 35

THE 21ST CENTURY SCHOOL

The shift from a teacher-centered model to a student-centered model has elicited a new type of architecture, driven by a need to change and a desire for better learning environments. The priorities for the best practices in school architecture can be boiled down into three categories:



Sustainability

- Wellbeing
- Energy
- Experience



Safety

- Bullying
- Intruders
- Evacuation



Function

- Program Agility
- Performance Agility
- Learning Agility
- Technical Agility



SUSTAINABILITY

When used in the built environment, the word sustainability often refers to the operational energy of a building. If the building performs more efficiently, it is considered ‘sustainable’. However, many factors fall under the umbrella of sustainability that go beyond building operation. Wellbeing offers inhabitants of the building access to fresh air, views, nature, daylight, etc. Essentially these are the elements of any good living environment that make up the nuts and bolts of a good space. Experience however, is often an overlooked aspect of sustainability yet it influences every aspect of the building from the embodied energy (the amount of energy used to bring the materials to the site and build the building) to the longevity of a structure. The rationale is simple: if the building is an enjoyable place to be, the longer it will remain. By incorporating quality experiences into a building that operates efficiently and provides



Fig. 9 - Sandy Hook Elementary school entrance, showing pedestrian bridges that lead into admin areas of the school.



Fig. 10 - Sandy Hook Elementary school drive up and drop off area with glazed atrium to see out onto play yard / approach



Fig. 11 - Sandy Hook Elementary School site plan



Fig. 12 - Small learning communities inside of Joplin high school, Joplin Missouri

the essential elements of a healthy lifestyle, the building is more likely to succeed than one that is for pure function.

For schools, the ability to foster all three of these experiences can help to teach students about being sustainable themselves by providing key moments of interaction with the building and its surroundings. The priority of sustainability then moves beyond an external goal and becomes an embodied experience, leading to more informed building operators and citizens.



SAFETY

It is impossible to discuss priorities in school without mentioning safety. While the importance of environmental safety

(earthquakes, fires, etc.) should be evident, it is in the last two decades that the topic of bullying and intruders has roared to forefront of the conversation about school safety.

Safety against intruders and the interaction of architecture share a critical relationship. CPTED (Crime Prevention Through Environment Design) is a concept used both in schools and in the public realm to use architecture, landscape architecture and urban planning to strategically create safer environments. The work of CPTED was officially published in 1972 in a book titled *Defensible Space: - Crime Prevention through Urban Design* written by architect

Oscar Numan⁹. His theories of crime prevention drew heavily on the work of Elizabeth Woods and urban activist and author Jane Jacobs. In fact, many of the notions of CPTED proliferate from good urban planning strategies identified in Jane Jacob's book published in 1960, *The Life and Death of Great American Cities*. For example, in her book, Jacobs describes the safety concept of "eyes on the street"; eyes on the street is passive surveillance. This is done by increasing visibility into and out of the public realm and reducing blind areas¹⁰. In the city of Seattle's CPTED guidelines, their four categories, landscaping, lighting, fencing, and windows all focus on one key element: increase visibility and establish better sight-lines¹¹.

Sandy Hook elementary school's redesign in 2016, following the tragic shooting

in 2012, applied many of the CPTED design principals. Pedestrian bridges over the rain garden, an atrium that looks out over an extended vehicle and pedestrian path into the building help prevent unseen people from entering the building. Clearer sight-lines, longer approaches and administration offices near the entrance help to regulate the flow of visitors by making them visible before they even reach the building. The themes of visibility also carry through to the interior of the school. For example Joplin high school's classrooms cluster around a glazed breakout space, creating better visibility between classrooms.



FUNCTION

School function is changing dramatically with the influx of technology. As mentioned previously, the teacher no longer acts as the sole giver of information but rather a curator or facilitator of information and knowledge. Architecture is beginning to adapt to this shift in meaningful ways. One of the largest changes

9 Newman, Oscar. 1973. *Defensible Space; Crime Prevention Through Urban Design*. Macmillan Publishing.

10 Jacobs, Jane. 1961. *The Death and Life of Great American Cities*. Vintage; Reissue edition.; pp. 33

11 Kathleen O'Toole, Chief of Police. 2017. Seattle Police Department. Accessed March 5, 2017. <https://www.seattle.gov/police/community-policing/cpted>.



Fig. 13 - Teacher assisting students in a DaVinci classroom

is the need for carefully orchestrated flexibility; this means that rather than simply providing large open, unprogrammed spaces, there needs to be a variety of spaces that are able to provide both private and collaborative spaces.

While the shift of the teacher's role is affecting the architecture of the 21st century school, the building itself must also be ready for future technology to be used. This type of technology can include future mechanical or energy gathering systems as well as new ways the users can interact with the building. In creating a school for the 21st century, it is vital that these foundations are laid for future function and flexibility.

TECHNOLOGY

In 2017 the amount of technology we use in our daily lives has continued to



Fig. 14 - Students sitting in re-purposed library

proliferate and expand. The use of smart phones, tablet devices, and computers have risen to the level of necessity in our daily lives. Children are now born into an age where they themselves are digital natives. Many adults and leadership are now fluent in technology yet the use of technology in the school curriculum and with the building is merely applied rather than integrated. Moreover, the technology we use is limited in how it reaches our senses. Tablets, smart phones and computers may claim to be “touch” but the haptic feedback is a small vibration motor transmitted through glass. Both for the integration of technology in schools and for the future of technology itself, a more meaningful conversation between the current state of digital devices and analogue, multisensory devices is required to truly integrate the experience. Schools

offer a unique opportunity to do this first by training students and exciting their imagination. This shift is beginning to happen with the reprogramming of unused spaces in existing school buildings.

Libraries are often targeted as an outdated concept in the digital age. However, while the way we access books has changed, the use and need for physical books remains. Unused areas of a library of existing school buildings are being reprogrammed as Da Vinci Studios, a fusion between an art and science space¹². This allows for maker projects using 3d-printers or shop spaces combined with programming robotics with the potential to create a beautiful art piece or a functional piece of technology. At its core it combines the best of STEM (Science Technology Engineering and Math) with art to generate STEAM (art included). While this re-imagining of space is a great step forward, there is more that can be done to improve the relationship between the

user and technology, and likewise the user and the building itself. To do this all the senses must be engaged.

12 Nair; *Blueprint for Tomorrow: Redesigning Schools for Student-Centered Learning*; pp. 127

CHAPTER IV

MULTISENSORY DESIGN



Fig. 15- More than sight

One common critique embodied in traditional and contemporary architecture is that it exists as an ocularcentric entity i.e., architecture's primary aesthetic motivation is to please the eye. Much of western philosophy prior to the 19th and 20th century confirms the amount of importance the sense of sight has in our understanding of the world. Many early architectural forms found in classical Greek or Roman architecture playfully manipulate the sense of sight to achieve visual harmony, correct proportion and shape. In addition, the depiction of Greek gods in classical Greek mythology were visually manifest to mankind and were also conceived to be spectators of human action and even provided a spectacle themselves¹.

This visually-focused thinking split into two opposing paths of philosophy in the early 20th century: a visually centered approach, and a critique against ocularcentrism in thought and perception. Martin Jay, a contemporary

critic on the effect of vision in regards to western thought and perception, in his book *Downcast Eyes: The Denigration of Vision in Twentieth-Century French Thought* analyzes how the optically-centered western culture separated through visually centered inventions such as the printing press, artificial illumination and photography. These inventions led to many of the visually-centered inventions we have today such as the computer or the smart phone which has resulted in a plethora of ocularcentric activities. Jay also examines the divide in French philosophy in regards to vision by examining French philosophers such as Jean-Paul Sarte, George Bataille and Maurice Merleau-Ponty and their influence on western thinking. These writers avidly argue against visual-primary perception in favor of a being-centered multi-sensory combination of perceiving and understanding the world². Contemporary sensory research agrees that our

1 Pallasmaa, Juhani. 2012. *Eyes of the Skin*. Hoboken.

2 Jay, Martin. 1993. *Downcast Eyes The Denigration of Vision in Twentieth-Century French Thought*. Berkeley University Press.

experience of the world is, in fact, not isolated through a single sense but is a complex interaction between all of our senses.

HOW DO YOU SEE YOUR BRAIN?

Our perception of how our brain processes information significantly shapes the way we seek to understand the world. The human brain is highly malleable and according to James Olds, a professor of neuroscience at George Mason University, “has the ability to reprogram itself on the fly, altering the way it functions.”³ The sociologist Daniel Bell posits that the tools we use to extend our mental capacity rather than our physical capacity begin to take on the characteristics of those technologies; he calls these “intellectual technologies”⁴. Essentially, we rewire our brain to fit into a model of how we think the brain is behaving. For example, in the early 14th century, the invention of the mechanical clock

spurred people to think about themselves and their daily lives as working “like clockwork”. Joseph Weizenbaum in his book *Computer Power and Human Reason: From Judgment to Calculation* observed that the clock began to reshape reality for people in the 14th century “in deciding when to eat, to work, to sleep, to rise, we stopped listening to our senses and started obeying the clock”⁵. This is also where the phrase “working like clockwork” was generated. In the 21st century we often think of our brains as a computer, imagining the amount of mental storage we have as hard drive space and how fast we process information as RAM or a CPU. However, according to contemporary neuroscience, our brain is unlike any computer system available. According to Jack Gallant, a neuroscientist from U.C. Berkeley our brains are more much more complicated and fluid than the computers we use today where the software

3 Olds, James, interview by Stephen Dubner. 2016. *Your Brain on Podcasts* (October 12).

4 Bell, Daniel. 1999. *The Coming of Post-Industrial Society*. New York: Basic Books. pp. xi

5 Weizenbaum, Joseph. 1976. *Computer Power and Human Reason: From Judgment to Calculation*. W H Freeman & Co.

and hardware are not separate but are intimately linked.

Our perception on how our senses work offers a similar dilemma to how we might perceive the brain. We often segregate our senses into 5 categories that work independently of each other. The reality of how our senses work however, is much more complex. While this topic is much larger than can be covered in this section, we will attempt to reorient our perception of the senses in order to fully understand their potential. Let's look at each sense as we know them in their separate categories and then the interaction between all five and what that means for the deaf and deaf-blind.

VISION

Sue Thomas was born deaf in 1950 and became the first deaf FBI agent to work for the undercover crime unit using her skills at lip reading. Thomas quickly became an astounding asset to the FBI because she could be placed in another room and see what

suspects were talking about without having to hear them⁶. Thomas was brought up in an intensive listening-spoken educational program where lipreading was the primary means of communication.

In her memoir, *FBeye* (later turned into a TV show under the same title), she credits her mother's persistence in having her practice in front of the mirror for hours. Consequently her mother also became a competent lip reader and the two would sometimes share silent conversations across the room⁷. Sue has many things going for her to become such an accomplished lipreader. Research suggests that being a woman provided her with an advantage. In addition, being deaf was an advantage as she had to rely on lip reading to acquire language. Furthermore, there is evidence that shows the brain reorganizes itself in early-deaf

6 Rosenblum, Lawrence D. 2010. See What I'm Saying: The Extraordinary Powers of Our Five Senses. New York: W.W Norton & Company. pp. 240

7 Rosenblum; See What I'm Saying: The Extraordinary Powers of Our Five Senses; pp. 241

individuals to relocate the areas used for hearing to increase sensitivity that process vision to become more acute⁸. This movement for “early-deaf individuals’ visual brain centers also shift so that the left side of their brain (for right-handed individuals) is more reactive to visual motion than their right; a reversal from that of most hearing individuals”⁹ Those who become deaf early in life are quicker and more accurate than hearing individuals at detecting the motion of objects. Their ability to take in and comprehend more visual information in a wider field of vision shows both the result of plasticity at work in the brain, and affirms deaf individuals’ need for visual interest and control. In fact, in regards to field of vision, it is “easier for hearing individuals to be distracted by images appearing in the central field of view, [whereas] deaf individuals are more distracted by images appearing in the

periphery.¹⁰”

At its core, sight allows for the input of objects from a distance. The observer doesn’t need to touch an object in order to receive information about it. For the deaf individual, the use of sight in almost every context is paramount to understanding the world. This happens critically with patterns of movement and architectural forms but also with the people with whom they interact.

When interacting with people, one of the most valuable pieces of information we receive visually is what the owner feels. Expressions are contagious. Research also suggests that we mimic the expressions of others in order to show empathy and understanding. These expressions not only have a profound impact on the interaction between two people but with an individual and their own emotions. Further conclusions are emerging that suggest our own facial expressions play a critical role in influencing

8 Auer, E., and L. Bernstein. 2007. “Enhanced visual speech perception in individuals with early-onset hearing impairment.” *Journal of Speech, Language, and Hearing Research* pp.1157 - 1165.

9 Ibid.; pp. 1157 - 1165

10 Ibid.; pp. 1157 - 1165

our emotional context. This is called facial feedback¹¹.

Facial feedback influences how people experience architecture profoundly. If individuals carry around emotions which are contagious, it is vital to consider the experience of the space as it relates to how it is received individually and then passed on collectively. A space that someone finds relaxing is likely to be passed on to the next visitor via facial cues and then internalized through their own facial feedback. This suggests that architecture must move beyond simply pleasing shapes and carefully engage all senses to elicit the desired outcome.

HEARING

In exploring the needs and senses of the deaf, the topic of hearing may seem of little importance. However, the degree of hearing loss among deaf individuals varies

greatly and even those who are considered ‘profoundly deaf’ can be influenced by sound. Background noise such as traffic, electronic buzzing or HVAC systems in a building can interfere with hearing aids and cochlear implants and cause discomfort and distraction. Seemingly unimportant elements of sound can tenaciously demand unwanted attention. But the perception of sound by anyone, deaf or hearing go far beyond what enters our ears.

Beethoven, the famous classical composer, is one of the more well known deaf musicians who sawed off the legs of his piano so he could hear the vibrations through the floor. We can feel sound vibrations with our entire bodies. Deaf people love to dance. At many concerts, in fact, you may see deaf people holding balloons so they can better feel the melody and music. While it is unclear what it is they experience exactly, it is clear that they enjoy it and are receiving similar information (melody, beat, timing etc.). The ability to hold a balloon and feel the melody shifts the input from the ears to the rest of the body.

11 Plotkin, Robert. 2014. Journal Work Philadelphia. January 14. Accessed April 3, 2017. <http://www.swprn.com/blog/charles-darwin-and-the-facial-feedback-hypothesis/>.

Essentially, one input is replacing another.

Nyle DiMarco is one of the most famous deaf celebrities in 2017 after winning first place in America's Top Model and then shortly after placing first with his partner Peta Murgatroyd on Dancing with the Stars. Before entering Dancing with the Stars, DiMarco admits that he hadn't really ever danced before but wanted to prove to the world that deaf people could dance¹². He and his partner worked out a series of hand squeezes, back taps and eye signals to make sure they were on the beat and in sync. In addition, the music was played louder and they danced on wooden floors so they could both feel the beat as they danced. For DiMarco, being deaf was not a hindrance but rather an opportunity to show how input and perceptions can change.

TOUCH

For deaf, deaf-blind and hearing the

sense of touch is a key sense that all three share. Communication for deaf-blind, while changing rapidly due to the introduction of new technologies, is primarily through tactile means. The bond between deaf and deaf-blind is quite special and the communication method between them is a method of sign language called tactile sign. In this method the conversation partner places their hands on the top and bottom of the signer's hands and reads the hand shapes and finger-spelling formed. However, many individuals don't know sign language and deaf-blind individuals must communicate using other means. The availability of portable text-to-brail translation devices makes it easier for non-signers to communicate with the deaf-blind¹³. Until more recent technologies, Tadoma was the primary method of communication taught to deaf-blind users. Helen Keller was one of the most well known users of the Tadoma method. The Tadoma method is a form of lipreading

12 Dimarco, Nyle, interview by Ellen Degeneres. 2016. Dancing with the Stars (April 13). https://www.youtube.com/watch?v=e_nIIcZBI54.

13 Rosenblum; See What I'm Saying: The Extraordinary Powers of Our Five Senses; pp. 142

that is performed through touch. The thumb rests vertically on the bottom corner of the speaker's mouth while the index finger rests under the chin and allows the remaining three fingers to gently touch the throat. In using this technique it is often easier for Tadoma users to understand men than women due to being able to feel more vibrations through the vocal chords¹⁴.

For deaf-blind individuals, touch is vital for navigating their environment. Blind and deaf-blind users are able to use touch at a more sensitive level than their hearing peers. Trailing is a technique used by blind individuals where the hand draws along a surface to guide the user where to go. For example, the underside of the counter in the cafeteria at Washington school for the blind has small bumps to indicate a measure of distance. A blind student can run their hand under the counter and know that in 5 bumps if they turn left and walk four paces they will come in contact with a table where they

can sit. While this is an intentional lead, deaf-blind and blind users regularly find these tactile markers throughout the environment. For example, feeling



Fig. 16 - TDU, Tongue Display Unit

the breeze of someone walking by can indicate how large or small someone is; or the cadence of someone's footsteps on a wooden floor can indicate not only that a person is near but who that person is judging by their gait.

TASTE

Taste in architecture is not usually considered a factor because who in their right mind would ever lick a building? Hopefully no one except in Willy Wonka's Chocolate Factory. However, the ability to 'taste' shapes and patterns is an approach to understanding space that has a great deal of nascent potential.

In the 1960s researchers developed

14 Ibid.; pp. 144

a device called a Tongue Display Unit, or TDU; this device was designed to help visually impaired individuals see with their tongue¹⁵. The device is similar to a small circuit board placed on the tongue of the user. The person controlling the device then uses vibrations placed on the circuit to describe the scene in front of the blind individual. “Without any training, subjects would be able to use this system to discriminate horizontal, vertical, and curved lines, as well as to detect simple targets so as to both point and turn toward them.¹⁶” With training, users reported that they were able to externalize objects they felt, saying they could “see” them where they perceived the objects to exist. As of this writing, users of this device are able to detect large objects and with training are able to navigate cluttered rooms¹⁷. While this hasn’t yet replaced the need for canes or guide dogs, the implications

are great. The ability to use our tongues to understand space shows both the power of neuroplasticity in the brain and also how much we are only beginning to understand about how our senses work together.

OLFACTORY

In his TED talk, Jipson Lee describes a particular product design problem he faced while in graduate school. As a student, their professor tasked them with redesigning a clock. Lee approached the design from the angle of creating an elaborate sundial. However, his classmate designed a clock that positioned magnifying glasses and cups filled with perfume in the correct solar orientation so that at a certain hour the sun would hit the cup of perfume and enhance the smell in the cup. This was a very clever way to approach this problem. In essence, anyone in the house would simply have to sniff to know what time it was. This approach to address our every sense is as vital in architecture as it is in product design.

15 Bach-y-Rita, P.W., & Kercel, S. 2003. “This device is the Tongue Display Unit, TDU.” *Trends in Cognitive Science* 7, 541-546.

16 Ibid.; 541

17 Ibid.; 546

ALL TOGETHER: THE ERGONOMIC BUILDING

Architecture now is in danger of repeating the same mistakes Le Corbusier attacked in the early 20th century; that architecture should be more like the automobile or the ship - designed for efficiency¹⁸. In the realm of an embodied experience, architecture falls dramatically behind product design in engaging the human experience. Much of how we design is based on the assumption that we move through the space but experience it mostly through our eyes. This could not be further from the truth. As we've seen in the last few sections of this chapter, the predominant theme that continues to arise is the human brain's wonderful ability to adapt and change through neuroplasticity. We are able to see feelings, hear movement, touch speech, taste space and smell time. As we've seen in each one of these categories, our generally accepted perception of these senses can change drastically, and our brain can adapt.

18 Corbusier, Le. 1923. *Toward an Architecture*. J. Rodker.

In many cases, our brain doesn't know or really care if we're seeing versus hearing or smelling versus touching. The important thread is that the ability for each of our senses to move and blend into each other allows us to begin to understand the implications this has on how humans experience space.

In architecture, rethinking how we understand our senses and the impact on how we experience space is important when considering the choreography of spaces in planning. In product design, “[e]rgonomics represent a sector of applied science which examines the laws and parameters of the work of humans. The practical goal of ergonomics is to create appropriate conditions for the execution of operational tasks.¹⁹” This definition of ergonomics applies to architecture by approaching building design in order to integrate interaction between the human and the building.

As technology continues to increase

19 Rosenblum; *See What I'm Saying: The Extraordinary Powers of Our Five Senses*; pp. 39

and become more pervasive, our ability to control and interface with the building at a basic, passive level and at a higher level is becoming unbounded. A multi-sensory approach, like a well designed car, must engage all of the senses, carefully and gracefully. Only in doing so can the relationship between building, technology and the human be a truly integrated one.

Architecture for the deaf provides a unique opportunity for designers to reconsider how the senses work by jarring our perceived outlook on the separation of senses. Only then are we able to start fresh and begin design with new eyes.

CHAPTER V

DEAF DESIGN IN PROGRESS: MODIFIED SPACE AND PROFESSIONAL PRACTICE



Fig. 17 - Deaf design in progress: modified space and professional practice

Throughout the research phase of this project, the foundation for the design project was built from over a dozen interviews at five different schools. Each of the five schools I visited in Washington State and Georgia were all built using the standard factory school model sometime in the 19th or 20th century. The only exception was Washington School for the Deaf who had the skill set of deaf architect John Dickenson. My goal in the interview process was to explore how the staff and students had modified their space to suit their needs. In addition to conducting

school interviews, I was able to interview award winning deaf-design specialist John Dickenson, founder and principal of Dickenson + Partners in Denver Colorado. These interview combined with examining some of the current work coming from Gallaudet University in Washington, D.C. helped to create a cohesive overview of modified deaf architecture and the best practices in the emerging field of deaf architectural design. From this research a framework emerged of design principals that can inform a cohesive design strategy for the deaf.

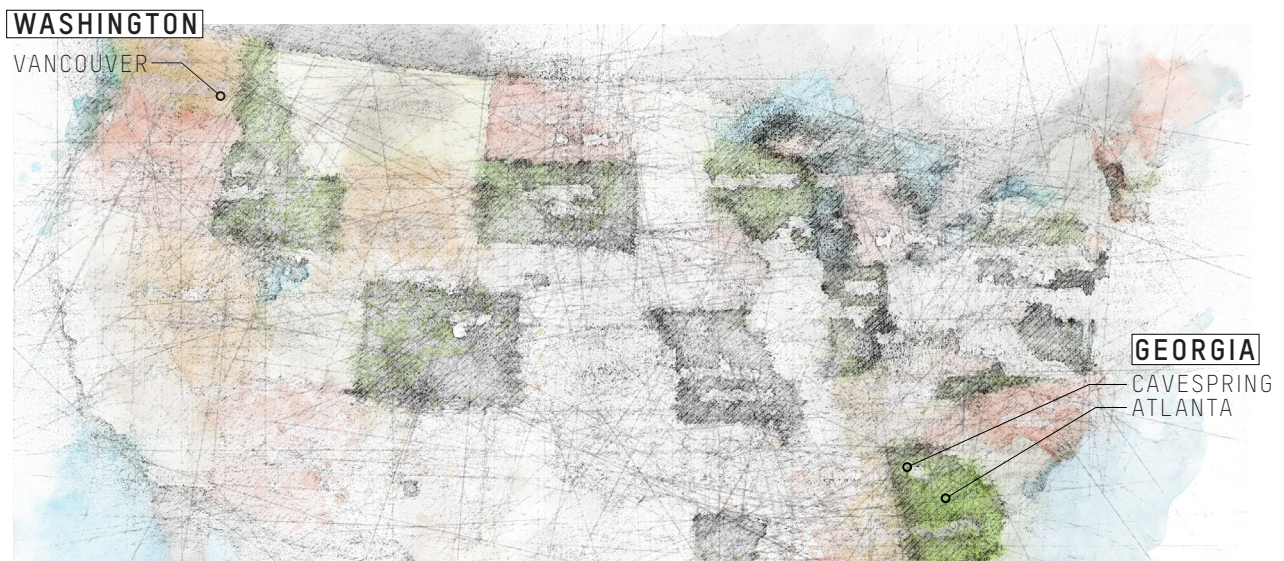


Fig. 18 - Map of the United States



ATLANTA SCHOOL FOR THE DEAF



GEORGIA SCHOOL FOR THE DEAF



ATLANTA SPEECH SCHOOL



WASHINGTON SCHOOL FOR THE DEAF



WASHINGTON SCHOOL FOR THE BLIND

Fig. 19 - Schools visited during interview phase

MODIFIED SPACE

ATLANTA SCHOOL FOR THE DEAF

Atlanta school for the deaf was founded in 1972 as a day school for deaf students. There are approximately 170-190 students that attend from elementary through high school. The original building was the elementary school and then the middle school and high school additions were added sometime in the 1980's.

The image to the right is a view of the intersection between the three schools. When asked about the staff's favorite space they took me here immediately. The teachers worked with the architects when designing this addition in order to help make the space more deaf friendly. The most significant features are:

- **Chamfered corners to increase visibility**
- **A reflective globe on the ceiling to increase spatial awareness**
- **A diffused skylight to eliminate glare**

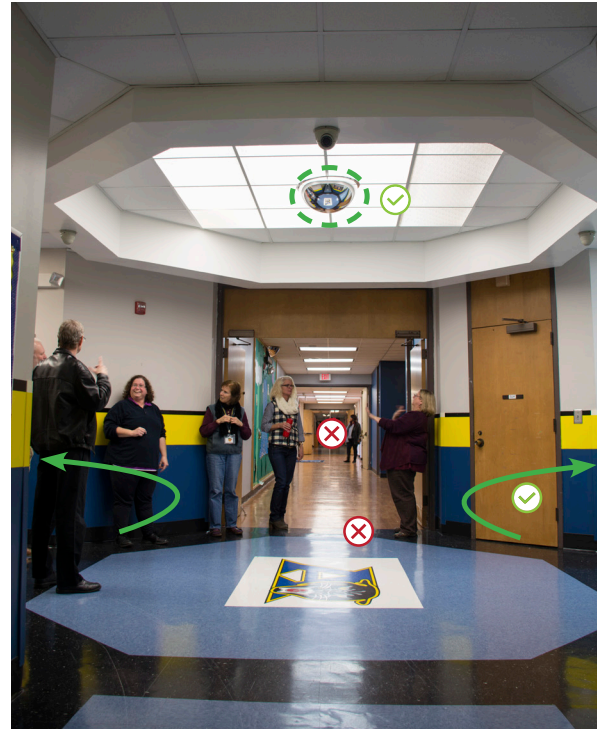


Fig. 20 - Atlanta school for the deaf intersection point

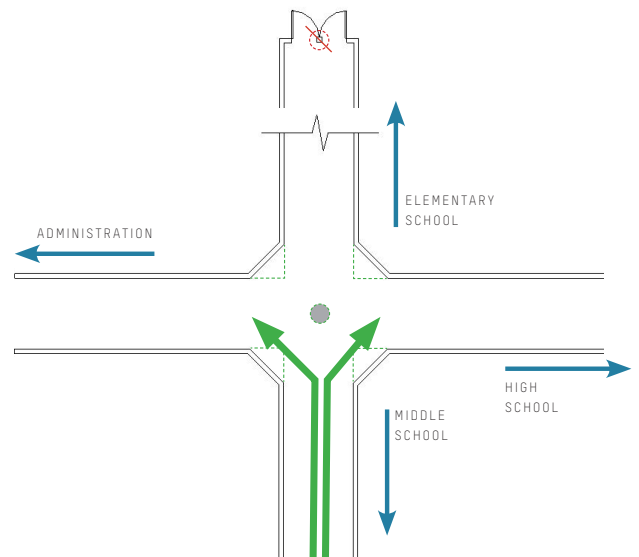


Fig. 21 - Atlanta school for the deaf intersection point, modified space



Fig. 22 - Atlanta School for the Deaf typical classroom

While this is a significant upgrade the remaining issues are: a mullion splitting the doors on the northern hallway and the highly reflective floor.

The Atlanta school for the deaf was original designed on the factory school model with double loaded corridors and hallways on either side. The typical deaf classroom is smaller than the average 800ft² classroom and holds roughly 8-14 students, instead of the typical 25-30. Small classrooms aid the teacher in managing visual distractions for deaf students. The key upgrades in this room are:

- **Cloth light diffusers**
- **U-shaped desk arrangement**

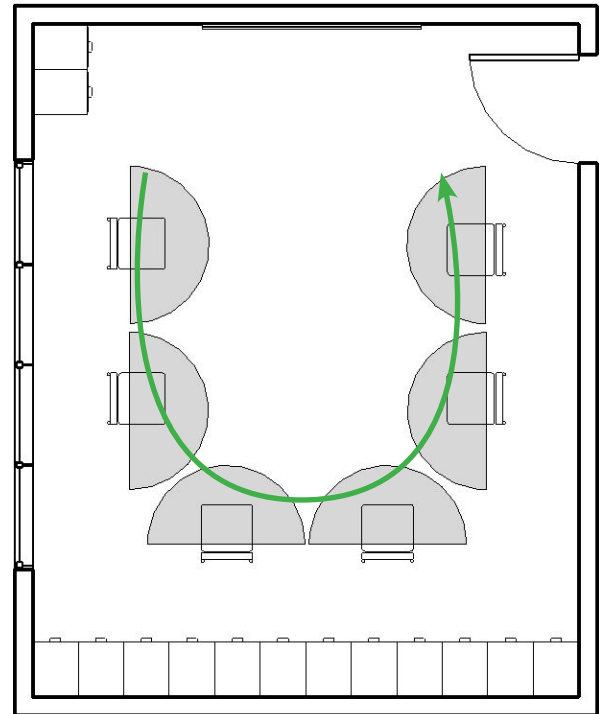


Fig. 23 - Atlanta school for the deaf typical classroom, modified space

The main problems that remain are the need for window shades to remove back-lighting and the lack of wall color increases eye strain.



Fig. 24 - Georgia School for the Deaf, administration lounge

GEORGIA SCHOOL FOR THE DEAF

Georgia school for the deaf, located in Cave Spring is a rural day and residential school founded in 1846. The school serves between 50-60 students from elementary school through high school. While the majority of the school mirrored a similar architecture to the Atlanta school for the deaf, one key feature included in this building was an emergency response device attached to the ceiling. The different colors signify different emergencies or notifications: blue for intruder, red for tornado and yellow for class change. Some of the issues that remained were highly reflective linoleum flooring and severe backlighting caused from high contrast

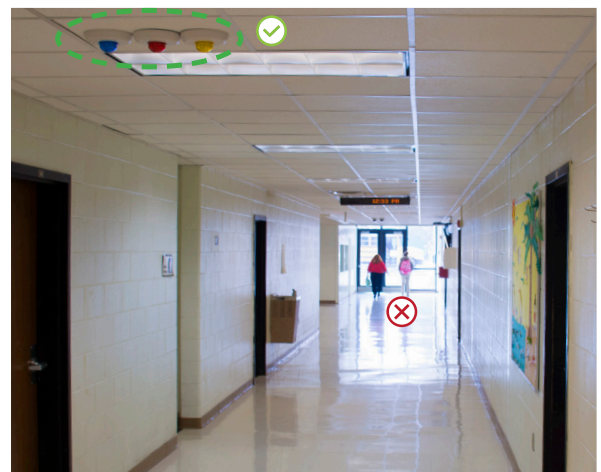


Fig. 25 - Georgia School for the Deaf, east facing hallway from the inside to the outside.

A space however that was recently modified was the administration area. In this lobby area a window was added for the secretary to see out and flexible furniture was added in a circle. The lighting in this space also included diffused lighting fixtures that helped reduce backlighting by evening out the



Fig. 25 - Atlanta Speech School, typical classroom, showing acoustic fuzz

spread of light from the outside to the inside.
ATLANTA SPEECH SCHOOL

The final school I visited in Georgia was the Atlanta Speech School. This school, unlike the previous two, did not use ASL as the primary means of communication. Rather this school specialized in assisting children with hearing aids and cochlear implants. The

architectural focus of this school focused primarily on increasing the quality of acoustics in the space. Each of the classrooms was acoustically sealed to isolate sound. In addition, acoustic fuzz and Acoustic Ceiling Tiles (ACT) were used throughout the space to help dampen reverberation. In each of the classrooms there was a speaker that projected



Fig. 26 - Atlanta speech school, cafeteria showing acoustic fuzz and clerestory windows



Fig. 27 - Washington School for the Blind, running track with hand rail

the teacher's voice from a microphone worn around the neck. This microphone was also able to connect directly to a child's hearing aid so the teacher could talk to that student directly if needed.

In addition to sound, Atlanta Speech School applied clever planning regarding glare and backlighting. Clerestory windows were used almost exclusively in classrooms and meeting areas and the floor was clad in wood which diffuses light significantly better than linoleum.

WASHINGTON SCHOOL FOR THE BLIND

Washington school for the deaf and school for the blind are located within

three blocks of each other in Vancouver, Washington. The school for the blind approached design differently than the school for the deaf. School for the Blind strategically removed barriers to the environment in order for students to navigate the space easier. When I first arrived at School for the Blind, I was surprised to find blind-specific design features to be very subtle. They existed in areas where they wanted to remove the barriers to perform a specific unique task, like sprinting. However, these barriers were not removed for every day tasks, like the kitchen. In fact, different appliances and room setups were designed intentionally so students will be exposed to a wider range of



Fig. 28 - Governor Baxter School for the Deaf, Falmouth, Maine

different environmental obstacles just like they would find in the real world. The rational is that if the school made the perfect blind environment, students wouldn't learn how to adapt in the real world after they graduate. This strategic planning of architecture and progression through the curriculum is a clever way to integrate architecture with the curriculum of a blind school.

PROFESSIONAL PRACTICE

DICKENSON + PARTNERS

John Dickenson is arguably one of the most famous deaf architects currently in

practice. In 1999 John founded Dickenson + Partners, an architectural office based out of Denver Co. Since its founding, Dickenson + Partners has won numerous awards for their work on projects specifically for those with special needs. The firm consults, designs and manages projects globally that specifically relate to deaf, blind or accessibility. Many of the best practices in deaf architecture, particularly in educational architecture, have been developed and applied by Dickenson + Partners.

John himself is deaf and provides a unique perspective on spaces designed for the deaf. In many of their projects, Dickenson + Partners strikes a careful balance between the

correct amount of controlled daylight and views in and out of the building. For example, in the Governor Baxter School for the Deaf, a K-8 school located in Falmoth, Maine, they achieve quality daylighting through orientation and window / skylight placement. For instance, by using light shelves and coordination of the ceiling geometry, contrast is reduced from the inside to the outside by splashing the wall with natural light. This evens the spread of natural daylight and increases the sense of transparency from inside to outside.

The quality and attention to detail is what truly elevates Dickenson + Partners architecture to such a high level of craft. Much of what makes deaf architecture truly work well is the creation of quality spaces. In essence, the quality of details (lighting and otherwise) will directly influence the functionality of the space.

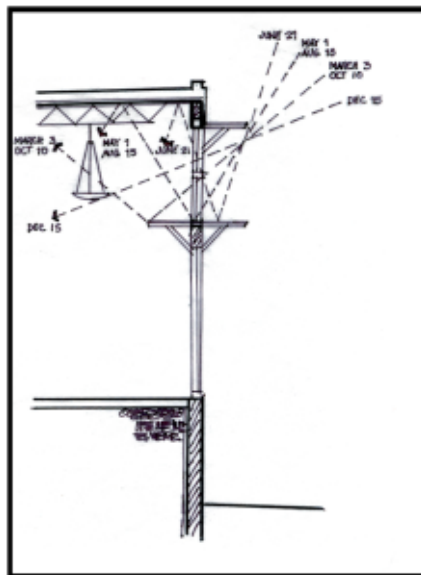


Fig. 29 - Lightshelf detail

GALLAUDET AND DEAFSPACE

Gallaudet university in Washington D.C. is the first and only university aimed towards deaf and hard of hearing students in the world. On the campus of this university ASL is the primary mode of communication among a variety of individuals with varying levels of hearing.

It is at Gallaudet where the beginning of what is being called “DeafSpace” began. It is an architectural movement started in 2007, geared towards identifying key deaf-specific spaces and buildings. Hansel Bauman, an architect from California, came to co-teach with existing deaf staff to think about what architecture for the deaf might look like. MJ Bienvenu, one of the assisting deaf professors and alumni from Gallaudet, stated that at the beginning, “we knew what [kind of architectural features] we didn’t want, but we weren’t sure what we



Fig. 30 - Sorenson Language and Communication Center

wanted”¹. Following this co-taught class a list of short principles and simple design-guidelines were created specifically for designing deaf spaces. The 5 key areas they identified were: 1.) Sensory reach - the distance one can communicate visually 2.) Mobility and proximity - the distance at which the deaf communicate while moving and the need for open space 3.) Space and proximity - distance and shape at which the deaf communicate 4.) Acoustics - distraction of ambient noise 5.) Color - use colors that don’t clash with skin tone². This list

was a great starting point to articulate some of the areas deaf design faces.

The most recent building on Gallaudet’s campus is the renovation of the Sorensen Language and Communication Center (SLCC) designed by Hansel Bauman in 2012, completed in 2015 which uses the design guidelines that emerged from the DeafSpace project. In addition, John Dickenson also consulted on this project. SLCC was quite successful in creating a space that addressed many primary problems that deaf people encounter in every day public buildings.

¹ Hurley, Amanda Kolson. 2016. How Gallaudet University’s Architects Are Redefining Deaf Space. March 2. <http://www.curbed.com/2016/3/2/11140210/gallaudet-deafspace-washington-dc>.

² Bauma, Hansel. 2012. DeafSpace. <http://www.gallaudet.edu/campus-design/deafspace.html>.

CHAPTER VI

DEAF-FIRST ARCHITECTURE: GUIDELINES

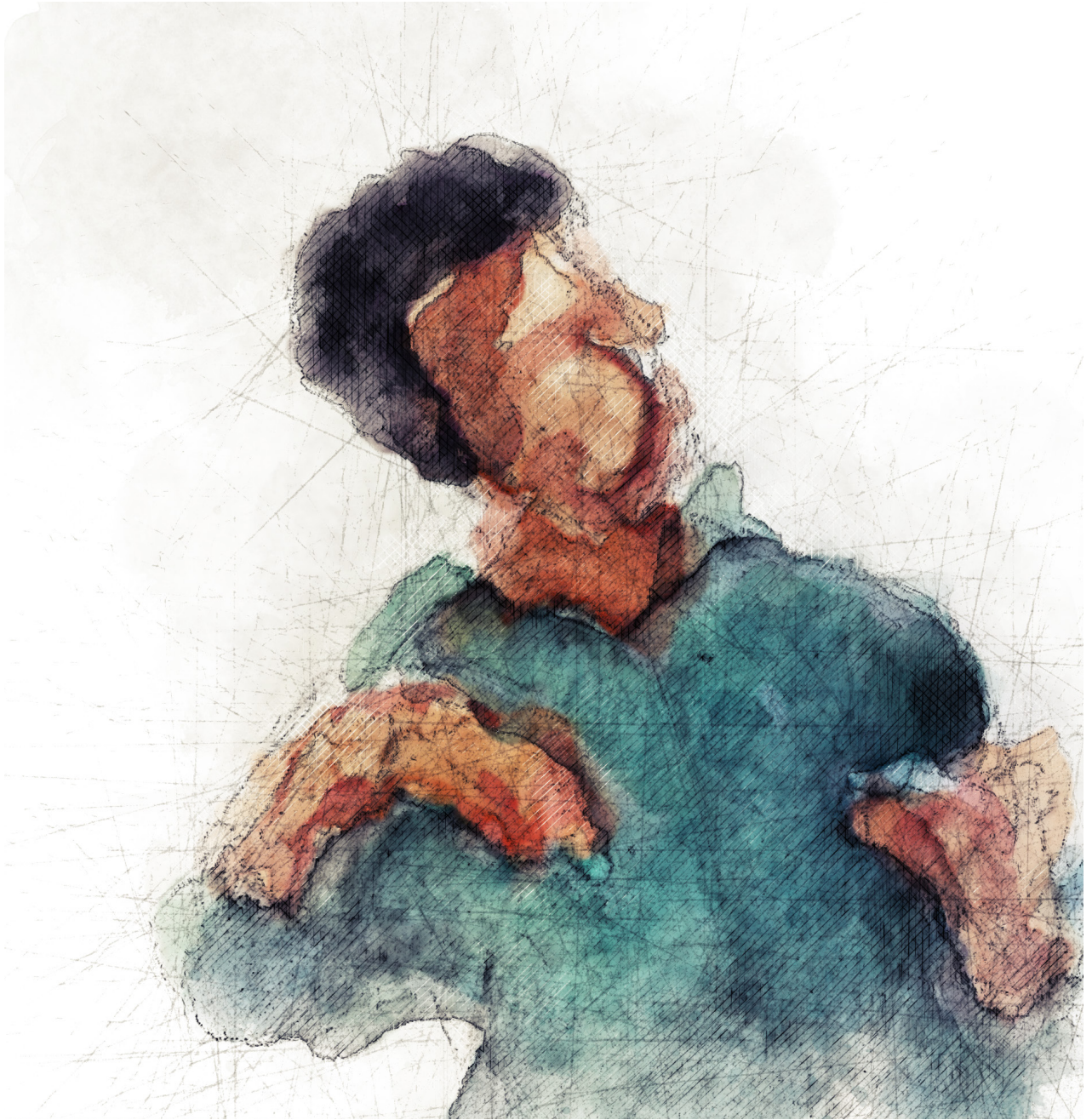


Fig. 31 - Deaf-first design guidelines

Architecture for the deaf has the opportunity to respond in a meaningful way to Deaf and hearing culture. The following guidelines are a synthesis of the interviews, case studies and research that explore what makes a space “deaf”. Each of the following six categories represent key areas that must be addressed when designing educational architecture for the deaf student.

DEAF DESIGN GUIDELINES

At its most basic level, architecture for the deaf is about strategically removing barriers to communication. Architecture for the blind focuses on strategically removing barriers to the environment. As we’ve seen in the previous chapter, much of the architecture found in schools for the deaf is adapted space; windows have been added, lights diffused, and corners softened. Overall great attention was given to increase visibility and reduce harsh light conditions. The following six categories are to be used as a bottom-up strategy for approaching educational architecture for the deaf



1.1) REMOVE OBSTACLES

Fig. 32 - Remove obstacles

Removing barriers in the environment that impede movement or visibility is vital. Some strategies might be to use ramps instead of stairs. Or if stairs must be used, it’s better to use wider stairs. When using sign language to communicate, the visual focus is on the conversation partner and not on the ground; elements such as high curbs or a misplaced

door mullions can become a walking or tripping hazard. Likewise, solid walls in and out of rooms can impede communication and spatial awareness in a negative way. Interior glass in key areas can help provide a vital connection instead of blocking it.



2.) REDUCE EYESTRAIN

Eyestrain occurs because of harsh light conditions. This can happen from poor electric lighting (as we saw in the previous chapter in Atlanta) or from harsh outside conditions entering the room. This usually happens on a sunny day when the outside is bright and the inside is dark. A typical

complaint for users of ASL happens when someone is standing directly in front of glass. This is called backlighting. This condition can be alleviated by either providing solid backgrounds or by decreasing the contrast from the inside to the outside through electric lighting or skylights. Another cause



Fig. 33 - reduce eyestrain

of eyestrain comes from glare. Glare occurs when a large area of bright light shines into the eye. In a school setting it is important to have even light distribution and to eliminate any areas of glare. This is particularly important for tasks using a digital device because harsh glare can impede performance from intense reflections, called veiling reflections. Some

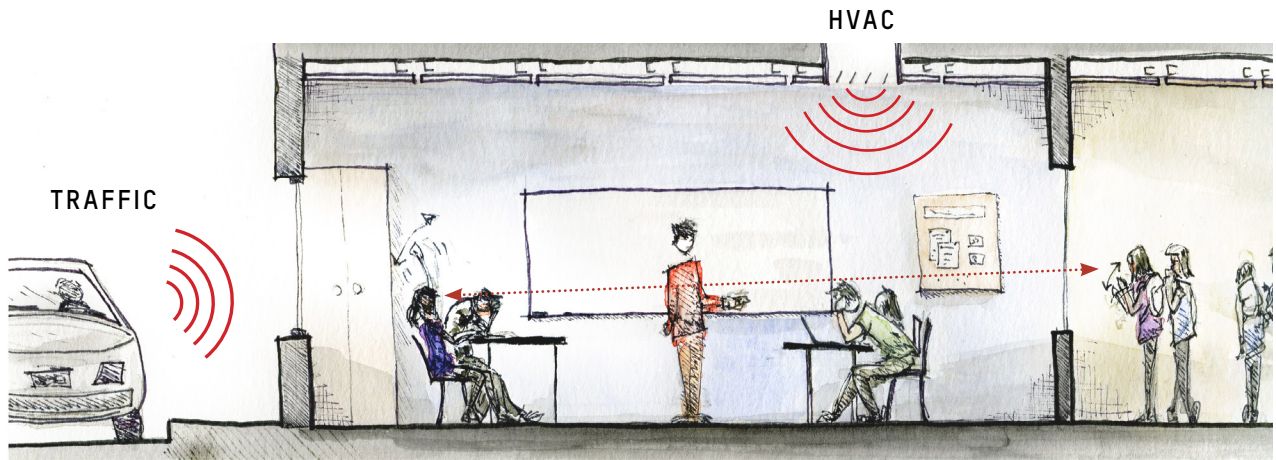


Fig. 34 - eliminate sensory distractions

strategies to reduce glare are to use diffused lighting inside, flooring and surface tops. These surfaces should have a more matte finish to disperse light and remove potential areas of glare.

3.) ELIMINATE SENSORY DISTRACTIONS

Distractions and unwanted noise can come from many different sources. For deaf individuals who wear hearing aids or cochlear implants, loud HVAC buzzing, traffic noise or other devices can interfere with signals or become shrill distractions. In addition, visual distractions can become an issue when concentration in a classroom is needed. Unlike

hearing students, a deaf student who looks away from the teacher or the screen misses 100% of the information being conveyed. In planning a classroom it is important to plan visibility inside and outside strategically in order to create connections but not distractions. Likewise, planning the placement of acoustic treatment, so unwanted sound distractions can be minimized, is also wise.

4.) INCREASE SPATIAL AWARENESS

Deaf people inhabit different sensory worlds than those who are hearing. It is important to maximize sensory awareness in order to assist with wayfinding and boost



Fig. 35 - increase spatial awareness

connections throughout the building. There are many strategies that can assist with increasing spatial awareness. Using wood or textured floor changes for example helps deaf and blind users feel a shift in differently programmed areas. Corner glass or chamfered / rounded corners assist with being able to see people approaching. Textured materials on wall surfaces also assist and can be used as a “lead” for blind or deaf-blind individuals. Reflection in key areas also assists with boosting one’s visual field.

Frequent display devices can assist with connecting people with the building’s

performance or school announcements. These areas could also be digital way points or areas of interest in the building. Atlanta school for the deaf uses a smart phone app for their high school students to deliver announcements or other school-related information. However, many students still do not yet own smart phones, particularly younger students. The frequent use of interactive display devices in the building could become an opportunity to learn, orient or inform.

5.1 FLATTEN COMPREHENSION

One area that is often overlooked in



Fig. 36 - Flatten comprehension

the design process for the deaf are emergency response devices. As we saw in the previous chapter, Georgia school for the deaf had installed a three-light system to indicate intruders, natural disasters or class changes. However, this device can only convey very basic information. In order to tailor messages to all students, a range of information must be able to be communicated quickly and efficiently. One strategy is the placement of large display devices prominently seen throughout the building. These display devices could both convey building information, student artwork but also broadcast emergency



Fig. 37 - Increase connection

instructions to all students at the same time. By making the broadcast visible as well as broadcasted through an intercom system, deaf, hearing or blind individuals could receive the same information at the same time, flattening the time it takes to respond.

6.1 INCREASE CONNECTION

Points of connection throughout and with the building help to create spatial coherence and ownership. Way points in the building can be as large as an architecture move or as subtle as a color change. In addition, creating space for student artwork and providing display spaces help give the building identity.



Fig. 38 - Mixed watercolor on test paper during project

DEAF COLOR

The use of color when designing for the deaf is an inexpensive tool that if used strategically can be very effective. Color and contrast are vital for users of signed languages to ease eye strain and increase visual competency. This exploration in color was done in watercolor to abstract and understand the wide range of human skin tones in order to inform architectural decisions about interior material and color choices.

The architect is able to use color strategically to enhance certain decisions about program and function. For example, using non-contrasting hues and values could discourage and move people through a circulation area; whereas complimentary colors and appropriate levels of value contrasts as a backdrop could encourage areas of refuge by increasing the legibility of one's hands.

The skin tone chart in Fig 39. represents an array of lighter to darker skin tones. In exploring this chart there are a few themes that emerge; the majority of colors fall into the

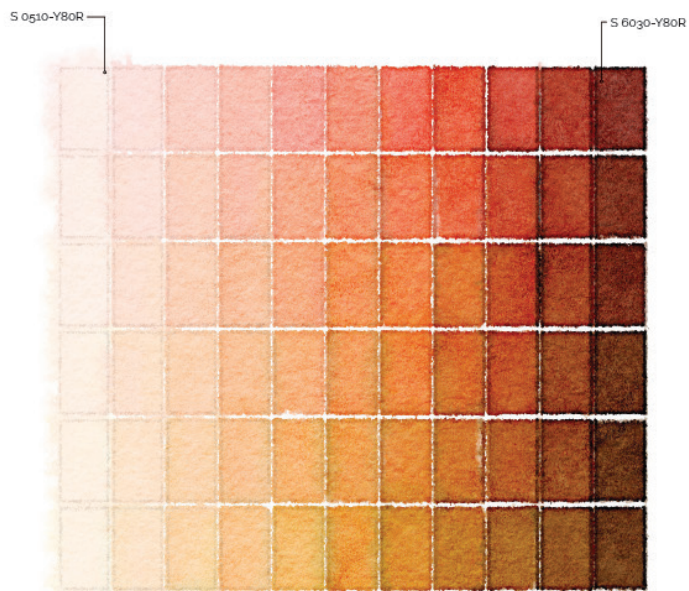


Fig. 39 - Skintone chart and inverse skintone chart

category of pink, red, red-orange, orange, yellow, brown, and yellow-orange. In exploring where each color lands on the NCS color chart, the range of skin tones span from Y0R to R10B. Pinker tones tend to land higher on white nuance with little shift towards chroma. Darker skin tones tend to land towards black with small shifts towards chroma. Red and orange however, lean more towards increased chroma, thus increasing their overall saturation.

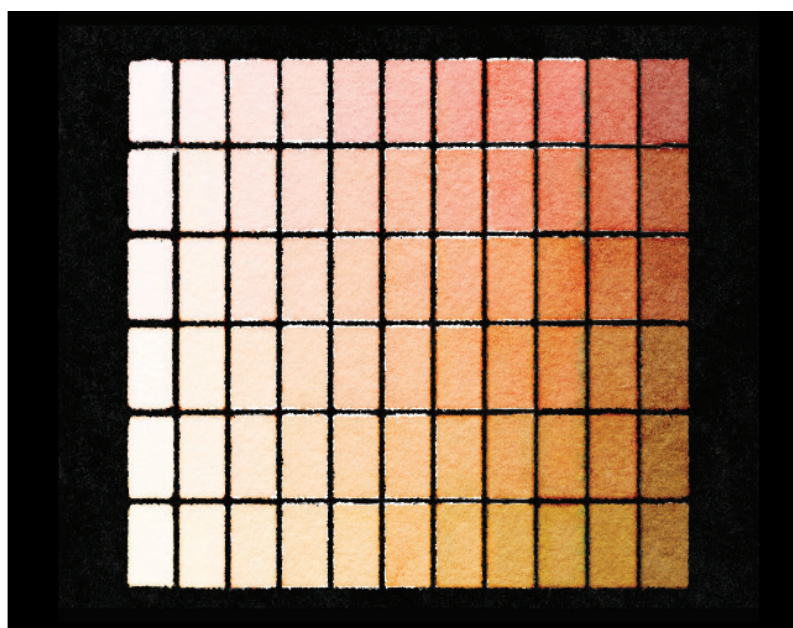


Fig. 40 - Skintone chart

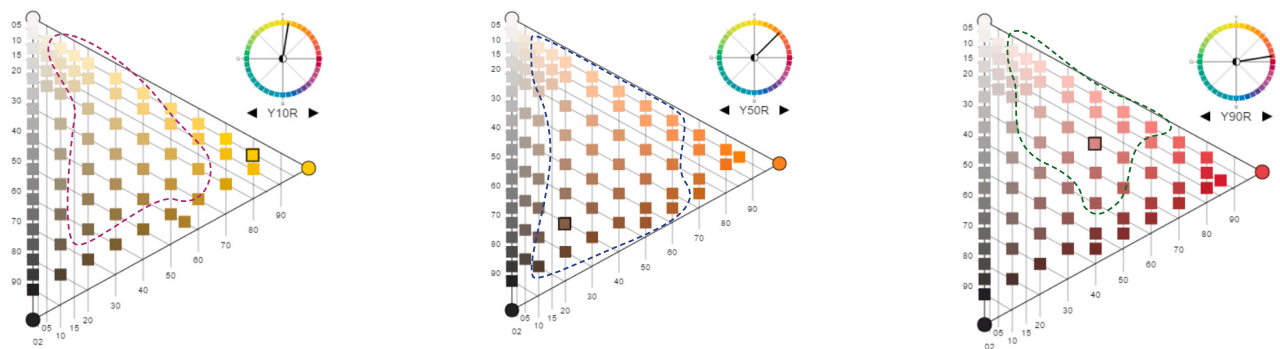
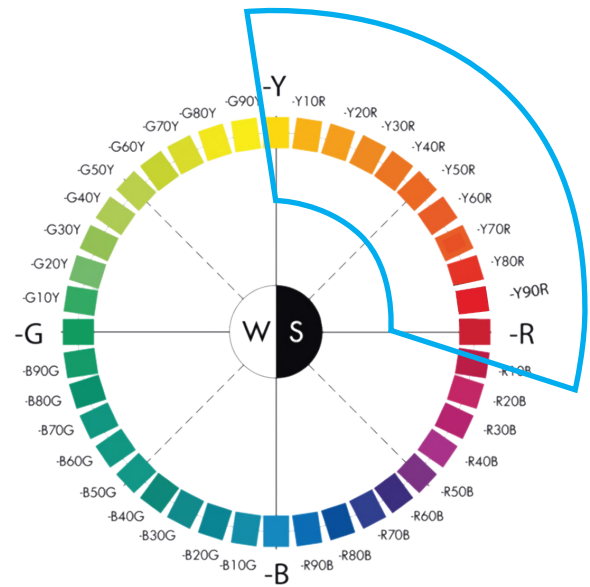


Fig. 40 - NCS color wheel and nuance charts

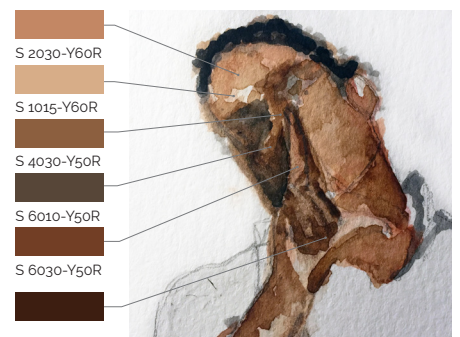
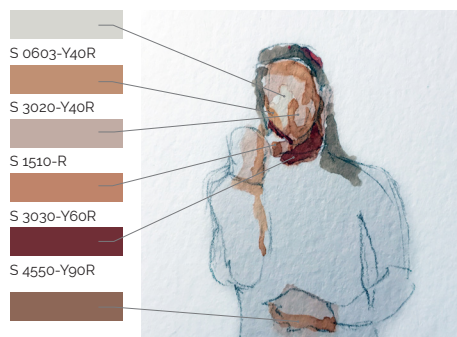
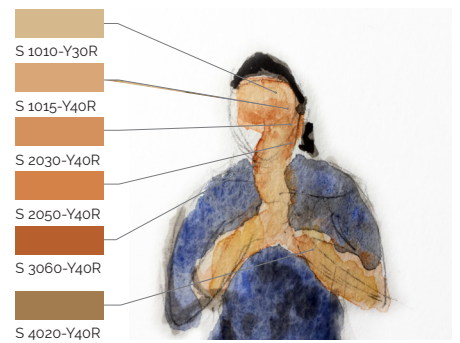
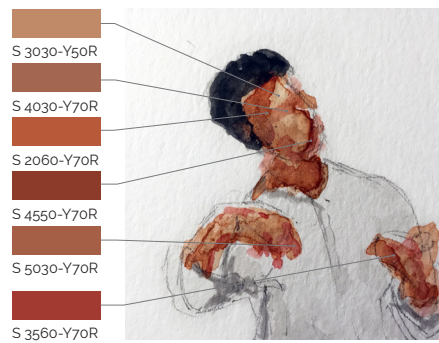
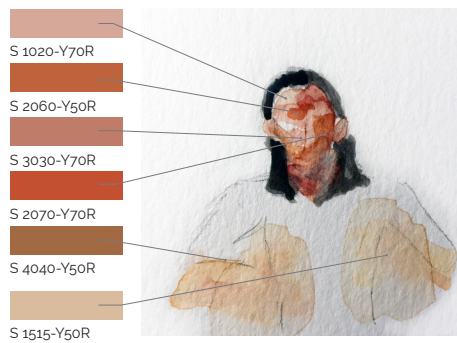
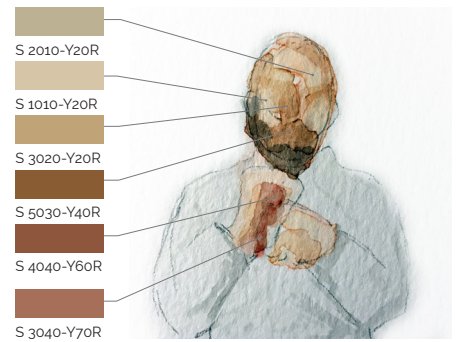
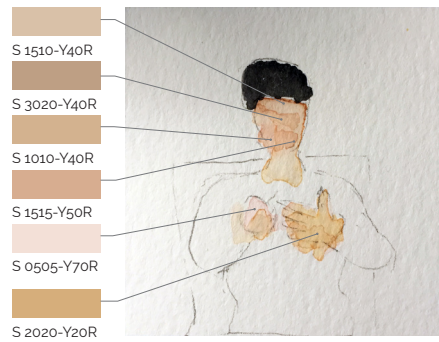
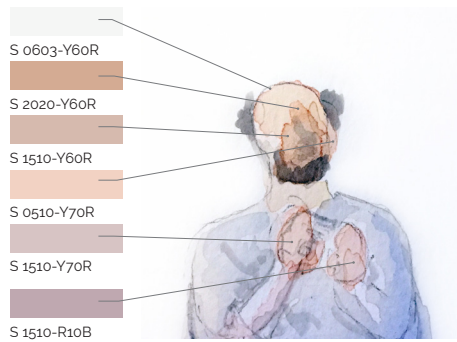
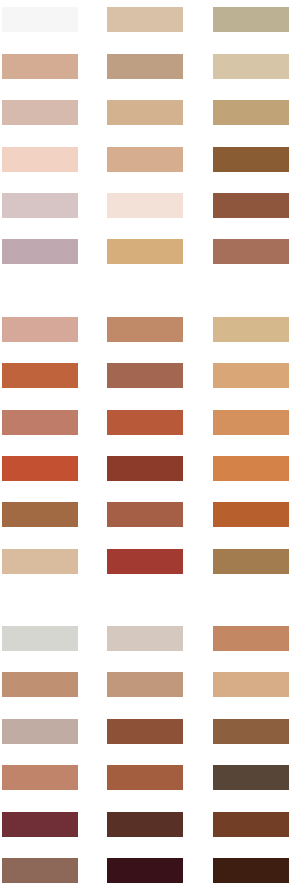


Fig. 41 - Skin tone exploration in watercolor

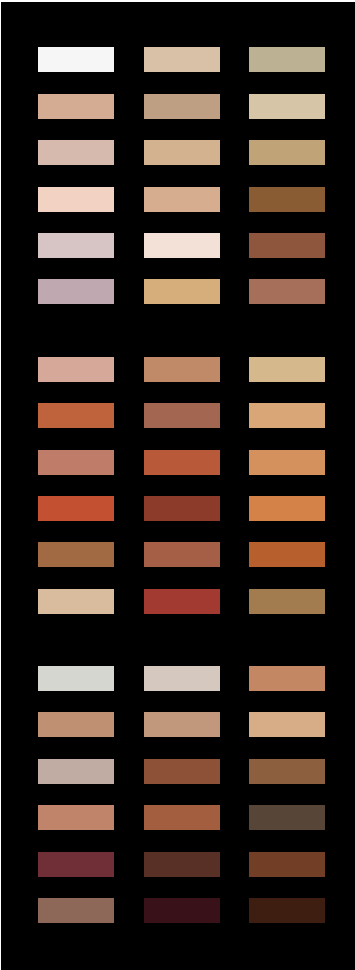
The variety of skin-tones give the designer a starting point when creating complementary contrasts. The most simple of these contrasts are on the opposite side of the color wheel. Below are the direct compliments to the skin tone palette. This com-

plementary color palette could begin with immediate proximity (clothes) but additional contrasts could be applied to larger areas of space such as walls, floors or ceilings. Below is a chart showing the skin tones from the figures to the left and their direct compliments.

SKIN TONE PALETTE



SKIN TONE PALETTE (INVERSE BG)



SKIN TONE COMPLIMENT (INVERSE BG)



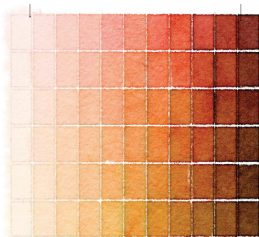
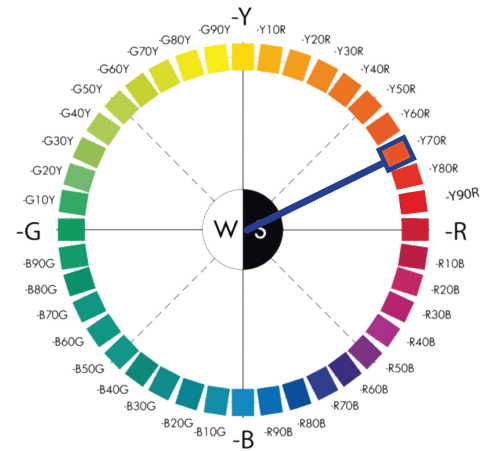
SKIN TONE COMPLIMENT



Fig. 42 - Skin tone palette

In the example below we can begin to see how a direct color compliment of blue-green to the red-orange skin tone begins to set-up a nice balance. Spatial effects also emerge as the shirt and skin begin to extend and advance against the darker backgrounds.

What these studies show is a strategy for choosing a coherent color theme that compliments skin tones and increases visual comprehension. Applied holistically to a project, these strategies begin to knit together the fabric of the building and can be used as a tool for both the designer and the building administration staff.



S 3030-Y50R
S 4030-Y70R
S 2060-Y70R
S 4550-Y70R
S 5030-Y70R
S 3560-Y70R

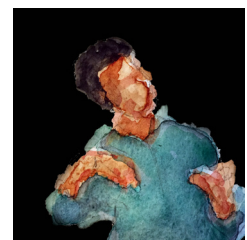
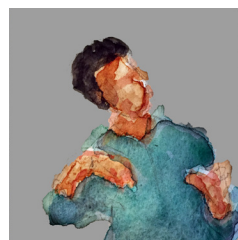


Fig. 43 - Skin tone breakdown

CHAPTER VII

DESIGN PROPOSAL: SEATTLE SCHOOL FOR THE DEAF, DEAF-BLIND AND HEARING

LEGEND

- NC3-65'
- NC3-45'
- RESIDENTIAL

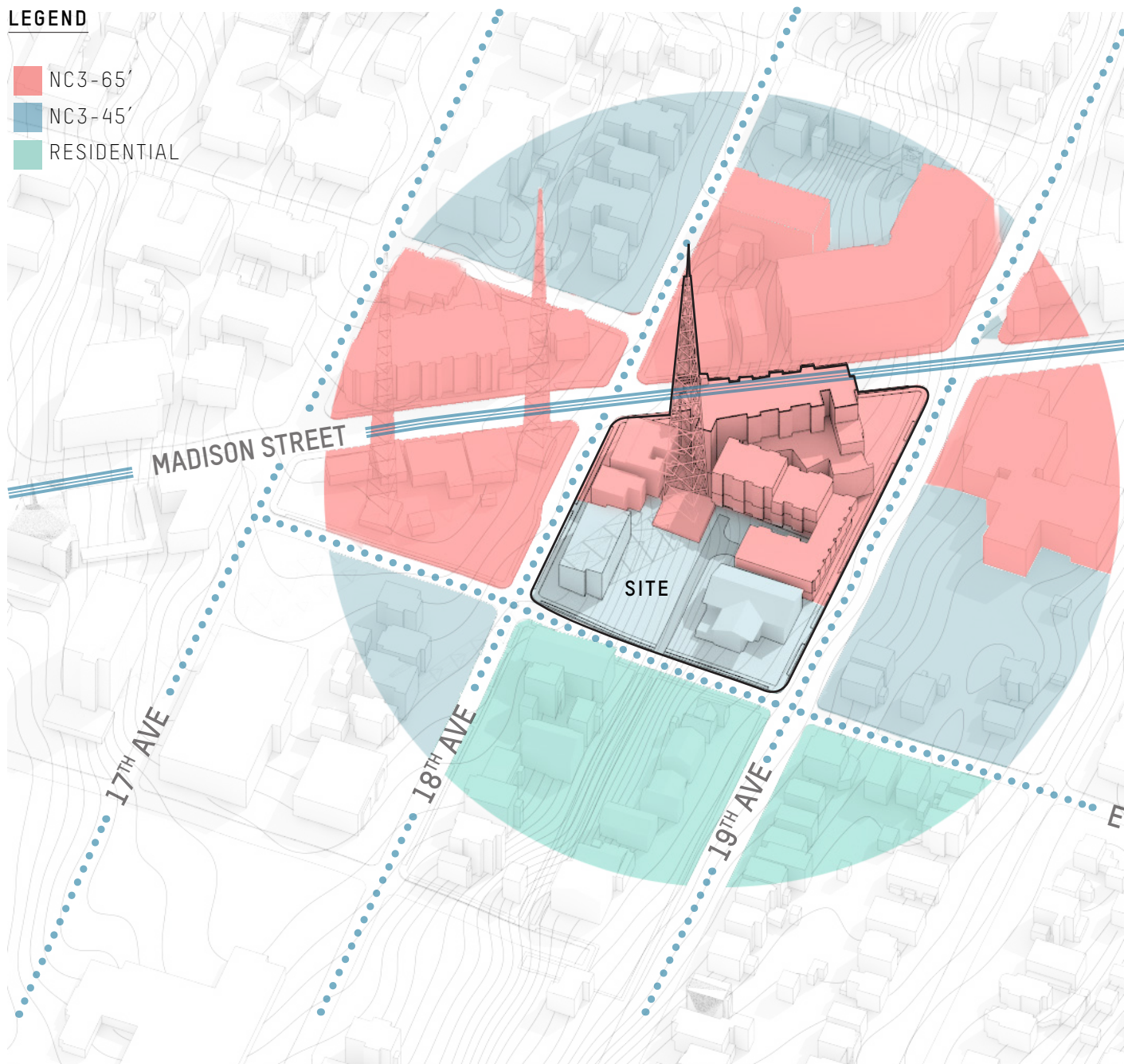
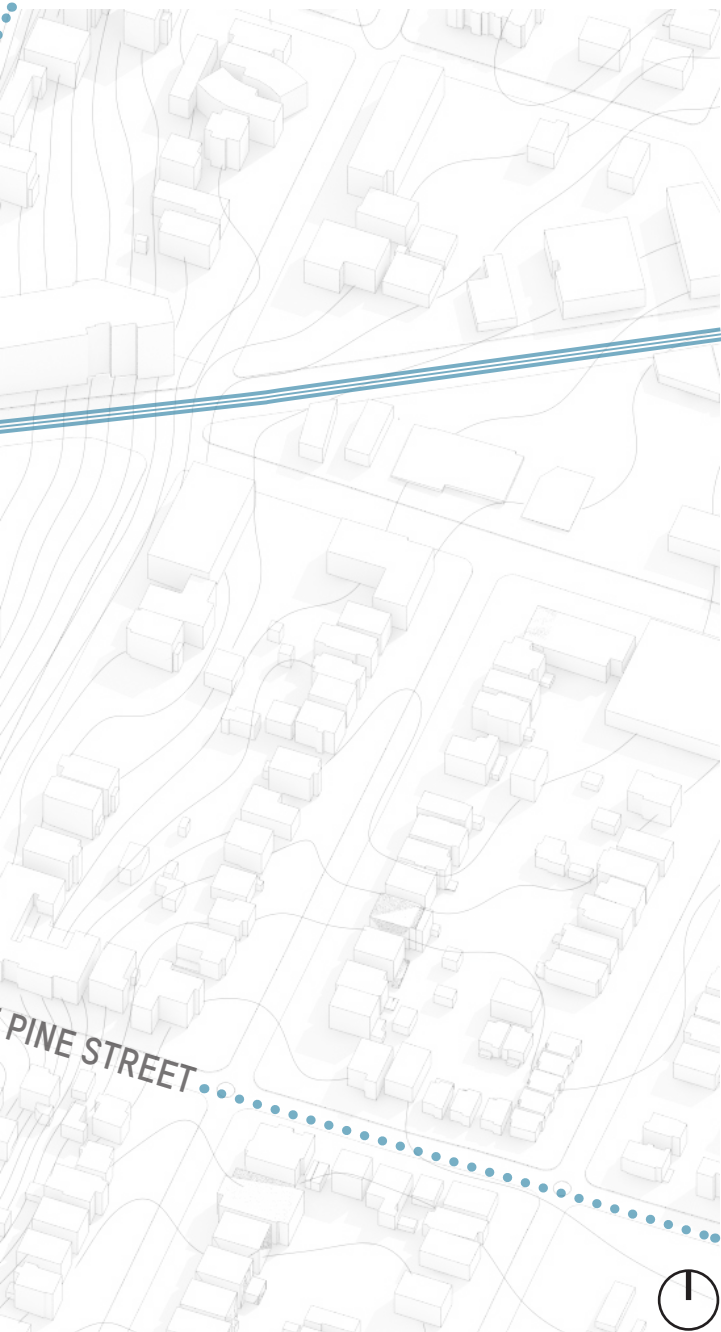


Fig. 44 - Project Site, 18th avenue and Capitol Hill



SEATTLE SCHOOL FOR THE DEAF: SITE

Located in the Capitol Hill neighborhood in Seattle Washington, the proposed site for the new Seattle School for the Deaf presented immediate challenges. The project was driven by a real client for a School for the Deaf who owns the block and the future site. The city of Seattle currently does not have a school for the deaf but will be building one in the next 3-5 years. This presented a fantastic challenge to apply and test the design framework to see what would emerge. The project set out to establish not only a day school, but relate to the existing context, connect to the existing buildings and respond to zoning and site regulations.

The zoning on the site shifts from NC3-65', which means the build height cannot exceed 65'-0", to single family residence to the south. There was an opportunity to respond to the scale jump from the north to the south in both the building scale and the program.



LEGEND

HSDC (HEARING SPEECH AND DEAF CENTER)

AFFORDABLE HOUSING

APARTMENTS

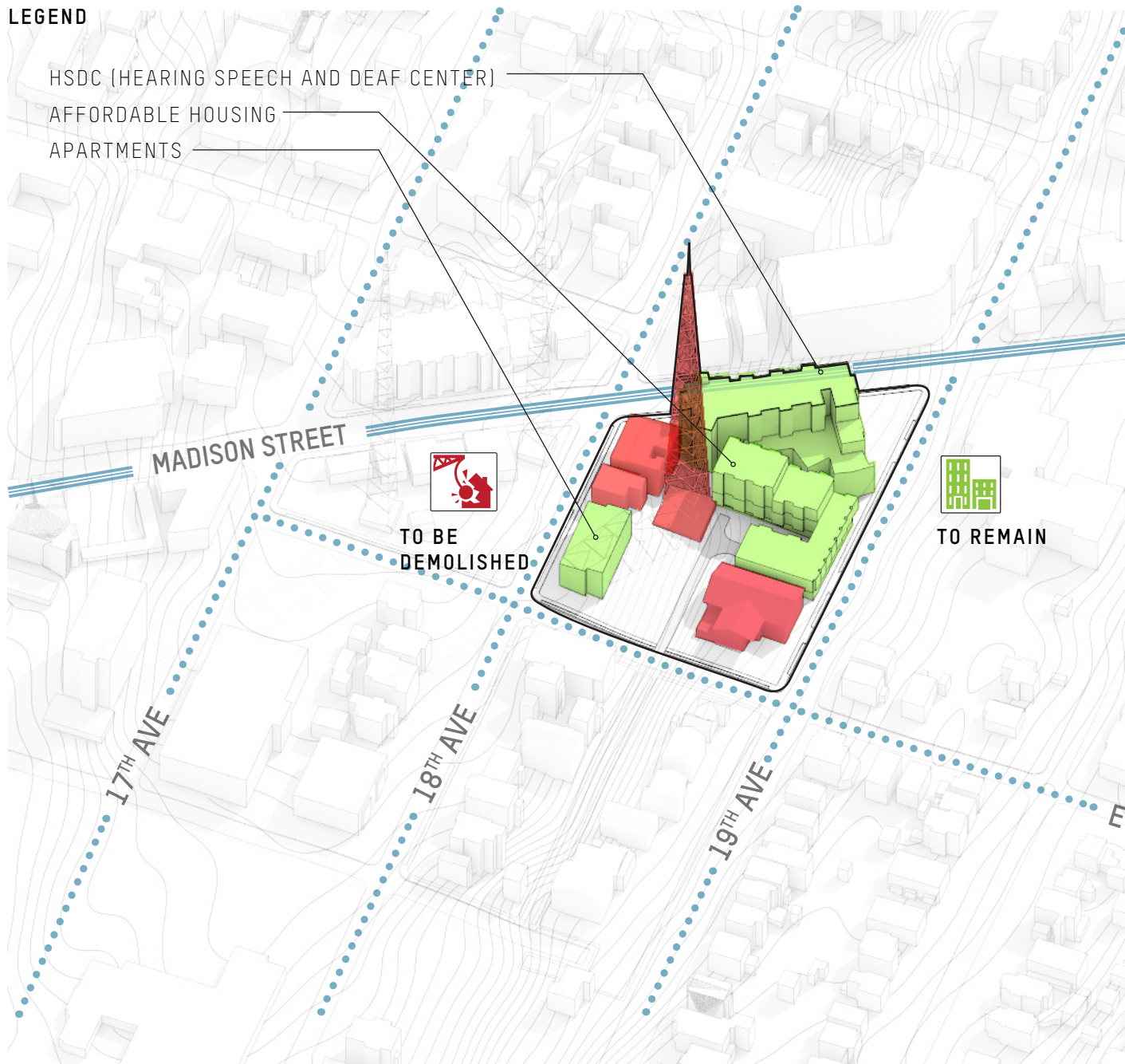
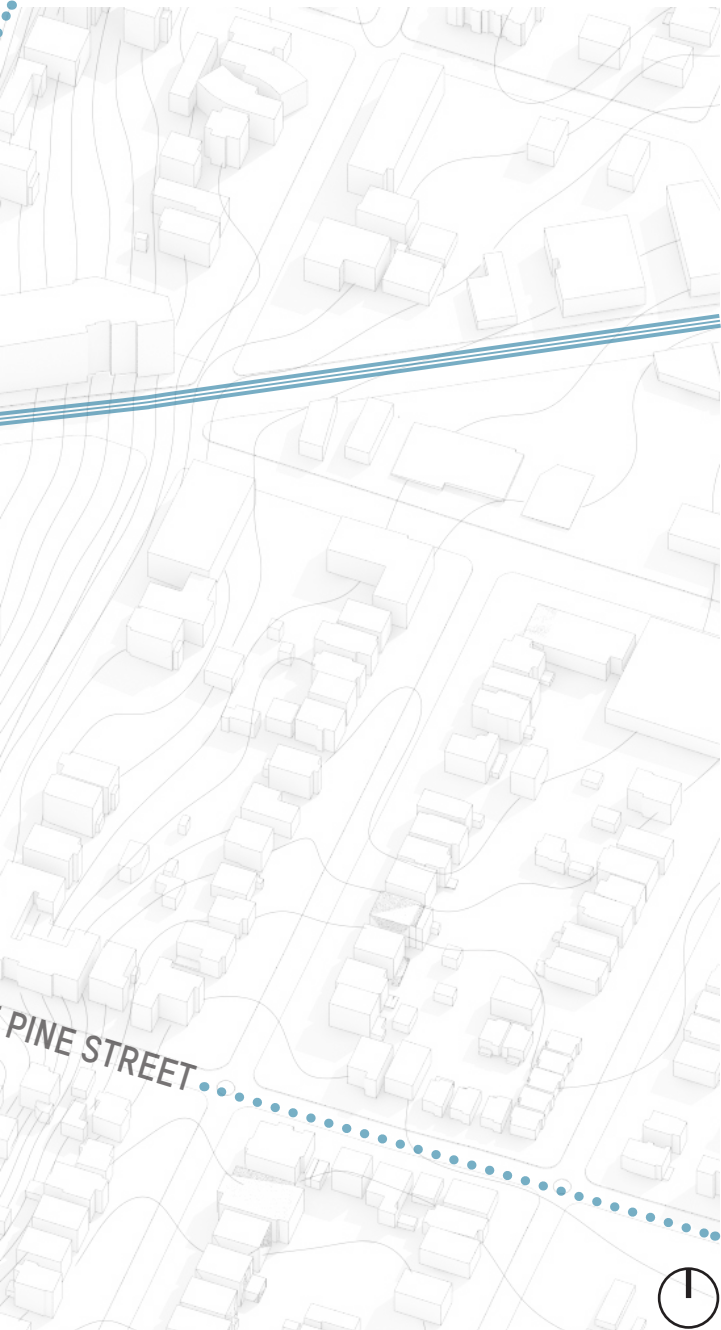
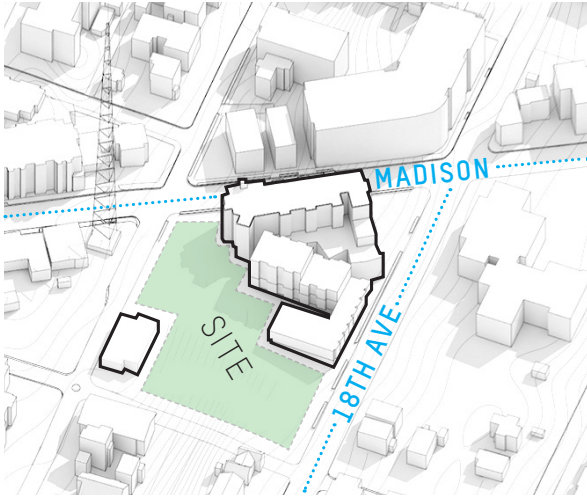


Fig. 45 - Project Site, buildings to keep and buildings to demolish



BUILDINGS TO DEMOLISH / REMAIN

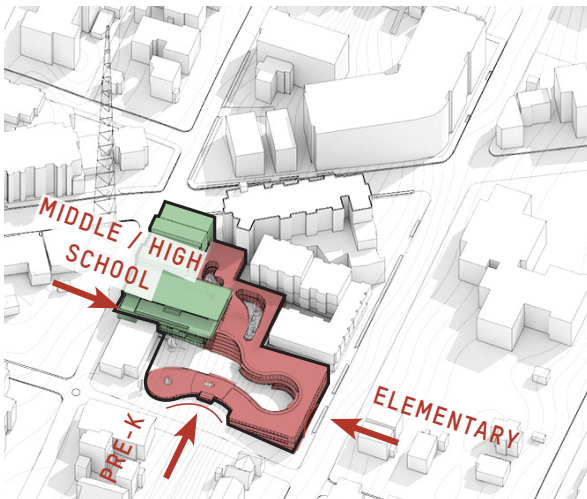
Three buildings are scheduled for demolition which create a cavity from the northwestern end of the site to the southeast. This became the building site. The buildings that were to remain on site were an affordable housing building to the west, and two apartment / office buildings to the northeast. There was a desire by the client to connect the office space of the existing building to the new school. The existing HSDC (Hearing Speech and Deaf Center), located in the northern most building, has an audiology clinic and prescribes and checks hearing aids. This program has the potential of synergy with the new day school. Starting with this base information, the programmatic needs began to unfold.



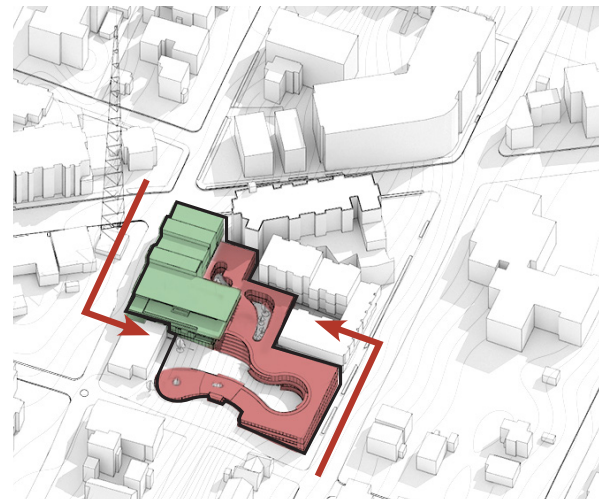
① CONTEXT + SITE



② HARD EDGES + SOFT CENTER



③ ENTRANCES + SAFETY



④ DEAF-FIRST + DEAF-ADAPTED

Fig. 46 - Building process and analysis diagrams



Fig. 47 - School program across the site

PROGRAM, SAFETY AND ENTRANCES

The program of this building spans from pre-kindergarten and early child intervention all the way through high school. Before anything else, basic school organizational practice had to come into play in order to meet safety needs first.

In organizing the program it seemed evident to scale the program in a way that matched the zoning on the site. The southeast side of the site is closest to residential zoning while the northwest relates to the taller building zone; by spreading out the program with the pre-k, elementary on the southeast side, the program was able to unfold naturally across the site, matching the jump in scale of the building with the program itself. Children would begin their schooling at the smallest scale of building and then work their way up into the largest scale, on Madison street as they move towards graduation. This allowed the building to organize itself into three separate entrances and to softly zone off younger children from older children.

WHAT IS DEAF ARCHITECTURE?

This question drove each aspect of the design and it became clear early on that this question had to be answered on all three major architectural fronts: architecture, landscape architecture and interior architecture. This

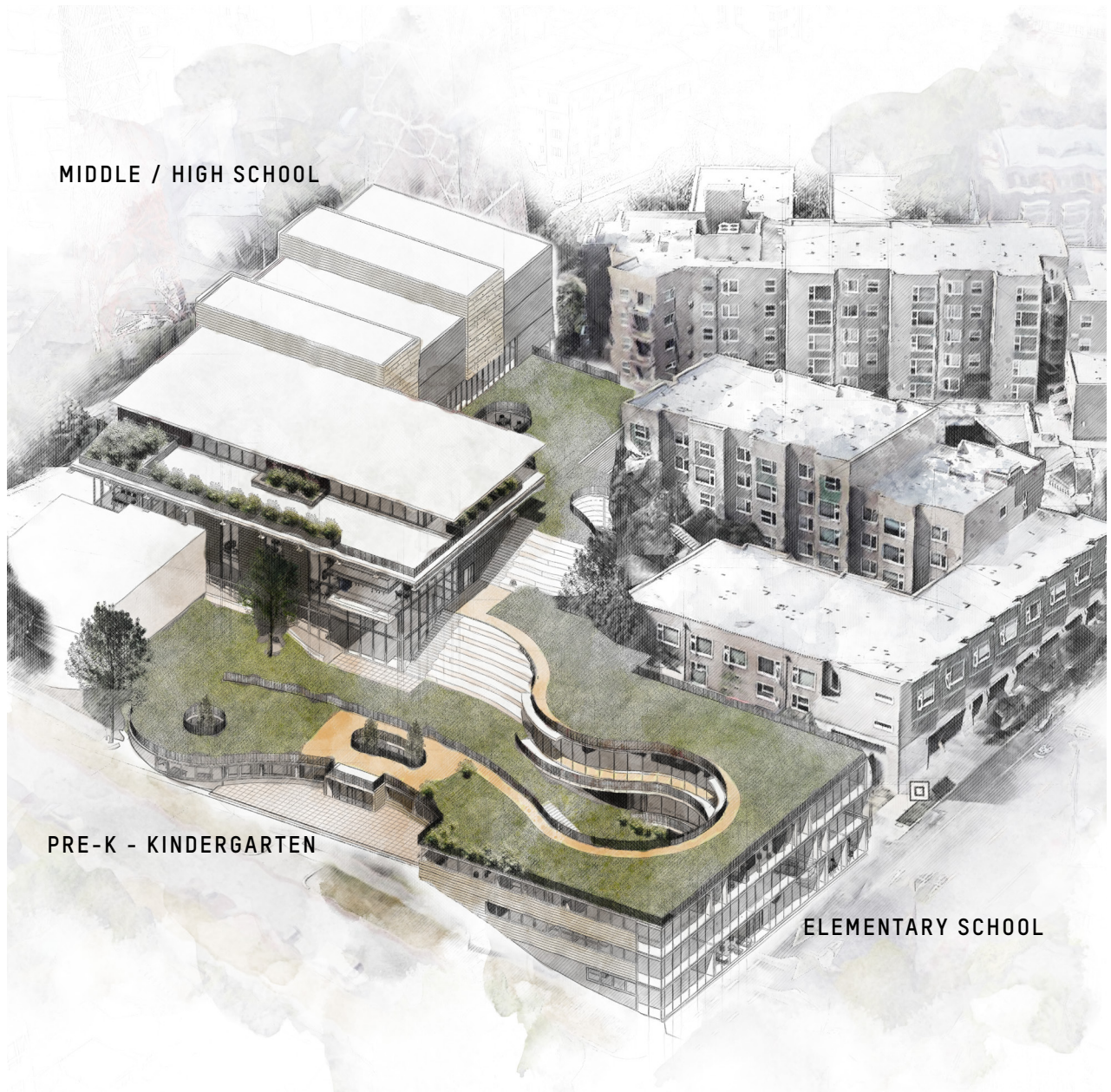


Fig. 48 - Deaf design in progress: modified space and professional practice

began by identifying what shapes deaf people naturally make. If you recall from chapter five, a lot of revisions made were done to existing schools to improve visibility. Deaf people naturally form U-shapes and circles when conversing with each other. Hearing shapes on the other hand, like the buildings existing on site, are much more orthogonal. Additionally, the strategies used at Washington School for the Blind also apply for a school for the deaf; deaf design needs to be strategic. If students only experience spaces that are extremely deaf friendly, they will have a difficult time when they leave school and must adapt to buildings that are hearing oriented. Conceptually, the building had to combine both deaf-first and deaf-adapted spaces. Coordinating this intersection was vital to creating a cohesive experience.

PATH AND CONNECTION

Path and connection to bind each building together cohesively was vital. Establishing a flow at the start of the program



Fig. 49 - Deaf shapes

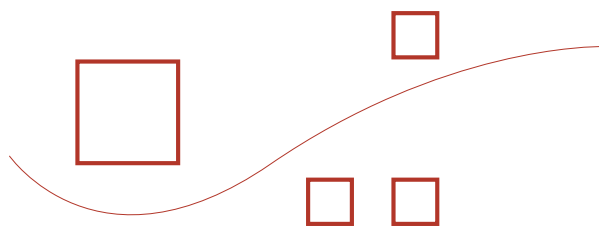


Fig. 50 - Hearing shapes



Fig. 51 - Deaf and hearing combined





Fig. 52 - In the yard, looking at middle / high school



Fig. 53 - Pre-k - kindergarten, floor 3 from lowest level

PRE-K AND KINDERGARTEN FLOOR

- 1.) ENTRANCE
- 2.) RECEPTION / PRE-K COUNSILING SERVICES
- 3.) WOOD PATH
- 4.) CLASSROOM WITH STORAGE CUBBIES
- 5.) PLAY / MULTI-USE AREA
- 6.) CHILDREN'S LIBRARY
- 7.) OUTDOOR GATHERING SPACE

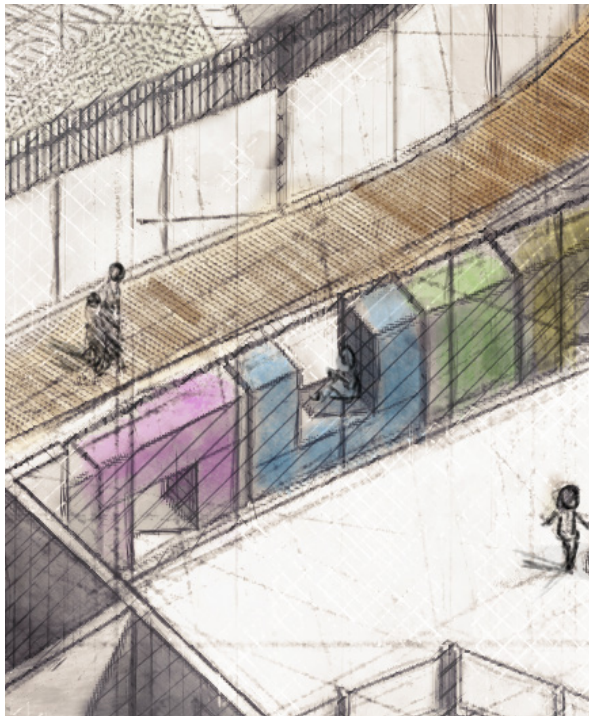


Fig. 54 - Textured cabinets used for storage, view correction and play

and maintaining it throughout was important. Wood became the binding material for the path as it functions well acoustically, reduces glare potential and is tactical. Beginning in pre-k, wood lines the entryway and the path continues through the kindergarten, stopping to create a threshold separating the children's library from the middle school / high school library.

In addition, along the path are cabinets placed in front of the primary classroom glazing which faces the kiva / courtyard. These cabinets perform three functions:

- 1.) Are places for storage and play
- 2.) Can be arranged to block or open up views
- 3.) Are textured / colored which offer a different interactive path experience.

The shape of the building is such to welcome new parents with deaf babies into the therapy center. Here is the most deaf supportive space. The curves in the building were designed in a way to maximize sight-lines





Fig. 55 - Elementary School Entrance

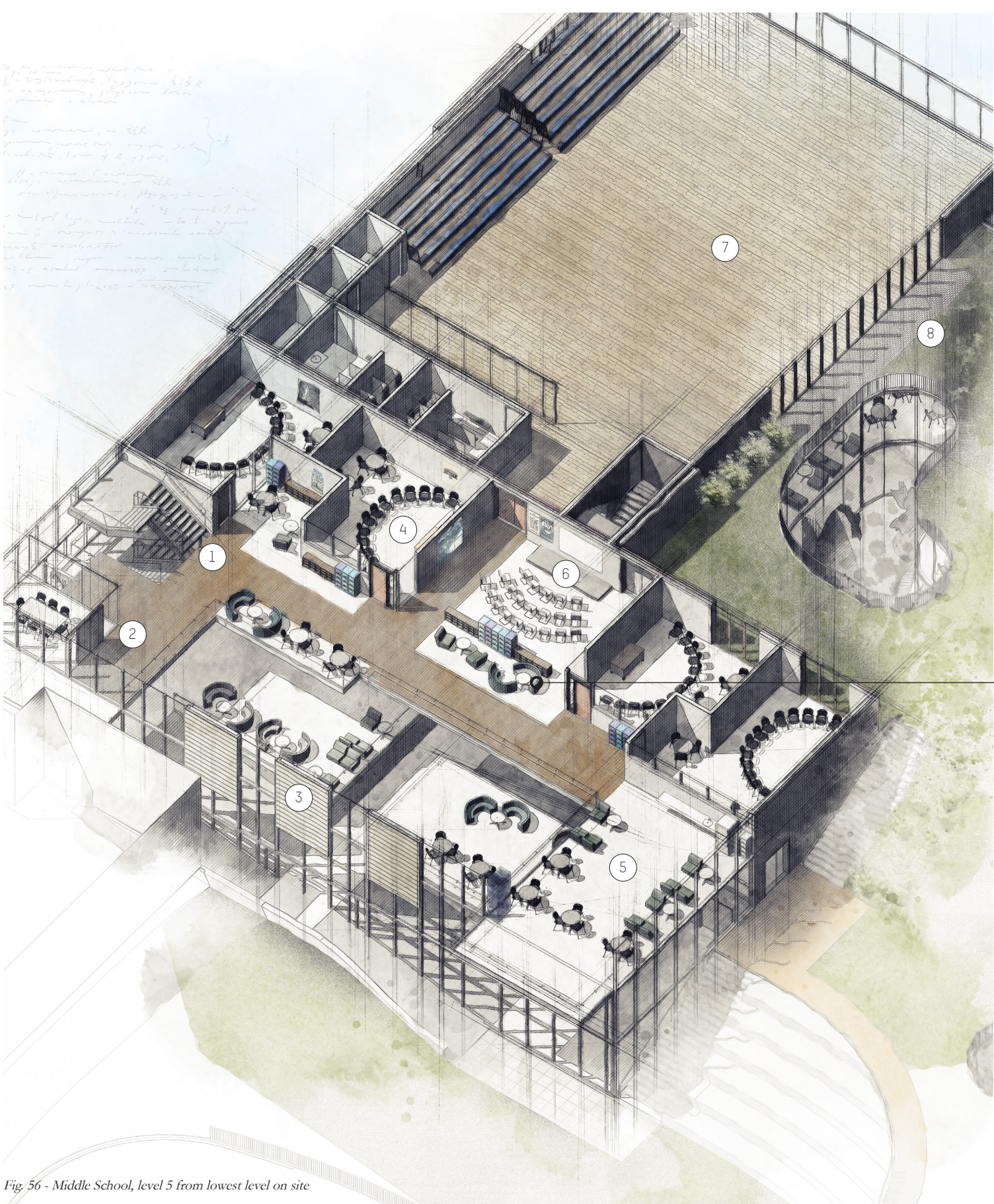


Fig. 56 - Middle School, level 5 from lowest level on site

MIDDLE AND HIGH SCHOOL

- 1.) STAIRS AND ELEVATOR
- 2.) BREAKOUT ROOM
- 3.) LARGE DIGITAL DISPLAY DEVICES
- 4.) CLASSROOM
- 5.) CAFE / WORK AREA
- 6.) PERFORMANCE AREA
- 7.) GYM
- 8.) GYM SPILLOUT DECK



Fig. 57 - Middle School performance area

and visual connections across the building and site. As the student moves through the program, the elements of deaf design remain but shift from determining the majority of the architectural form to adapting to it. Students who enter middle school are then ready to experience deaf architecture in a new but meaningful way.

DEAF-ADAPTED

As the student moves up into the middle school and high school, the previous building becomes the park and the high school becomes the object in the park. The high school houses programs that are orthogonal in nature such as the gym thus allowing the rest of the architecture to adapt to deaf needs in a different way.

In the high school each of the deaf design guidelines are still in place but appear in different ways than in the kindergarten / elementary school. Views throughout the atrium space allow for views on any floor as well as across. The southern glazing wall and





Fig. 58 - Middle School Atrium and Classroom Floor

large roof overhang also shield the classrooms from harsh sunlight conditions. Corner glazing increases spatial awareness and the wood path remains to separate circulation from areas of refuge. Large display devices hanging inside the curtainwall allow for easy broadcasting and student displays. While the architecture of the high school / kindergarten differ, the essence remains: each building is truly deaf-first.

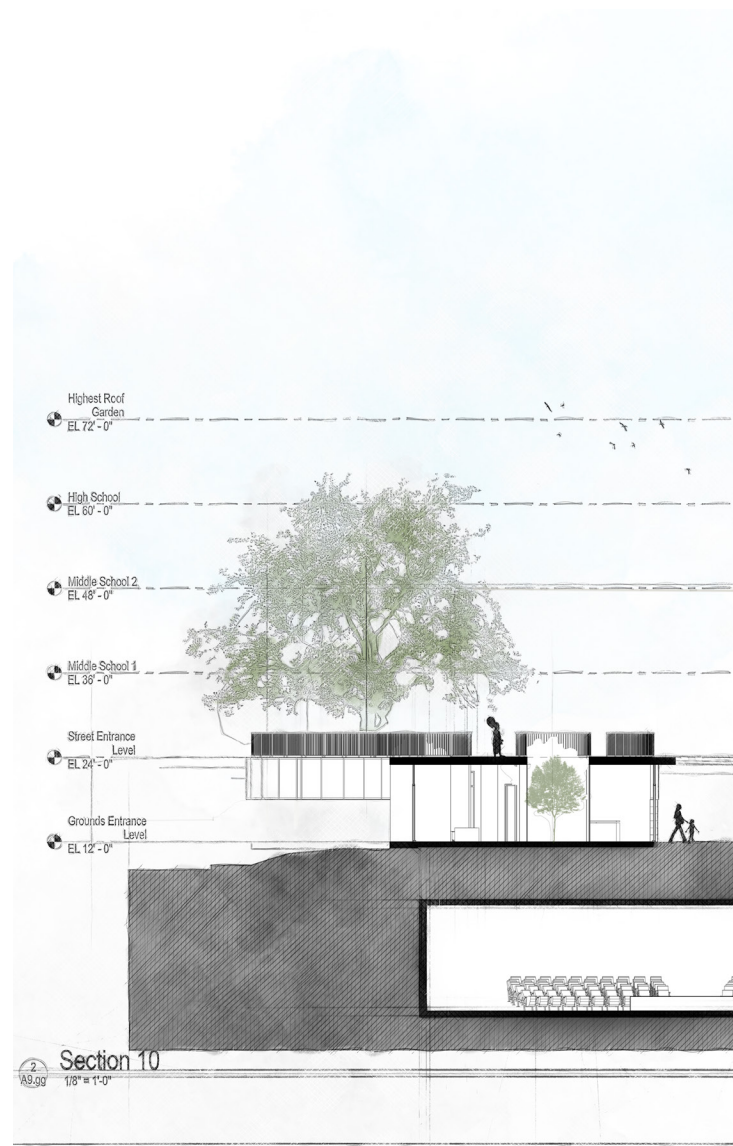
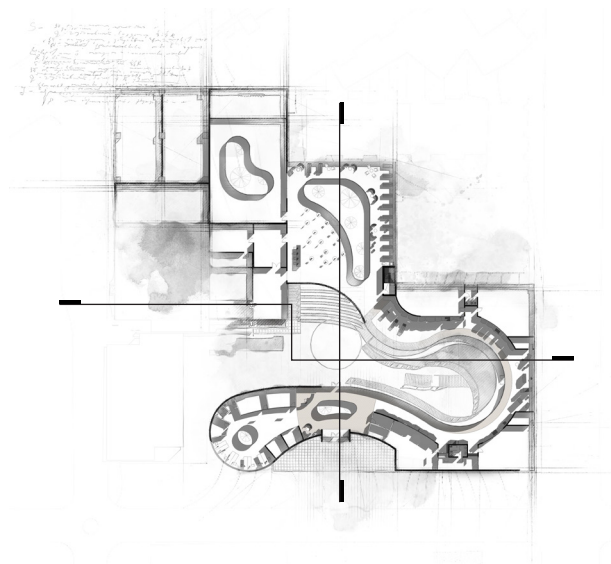
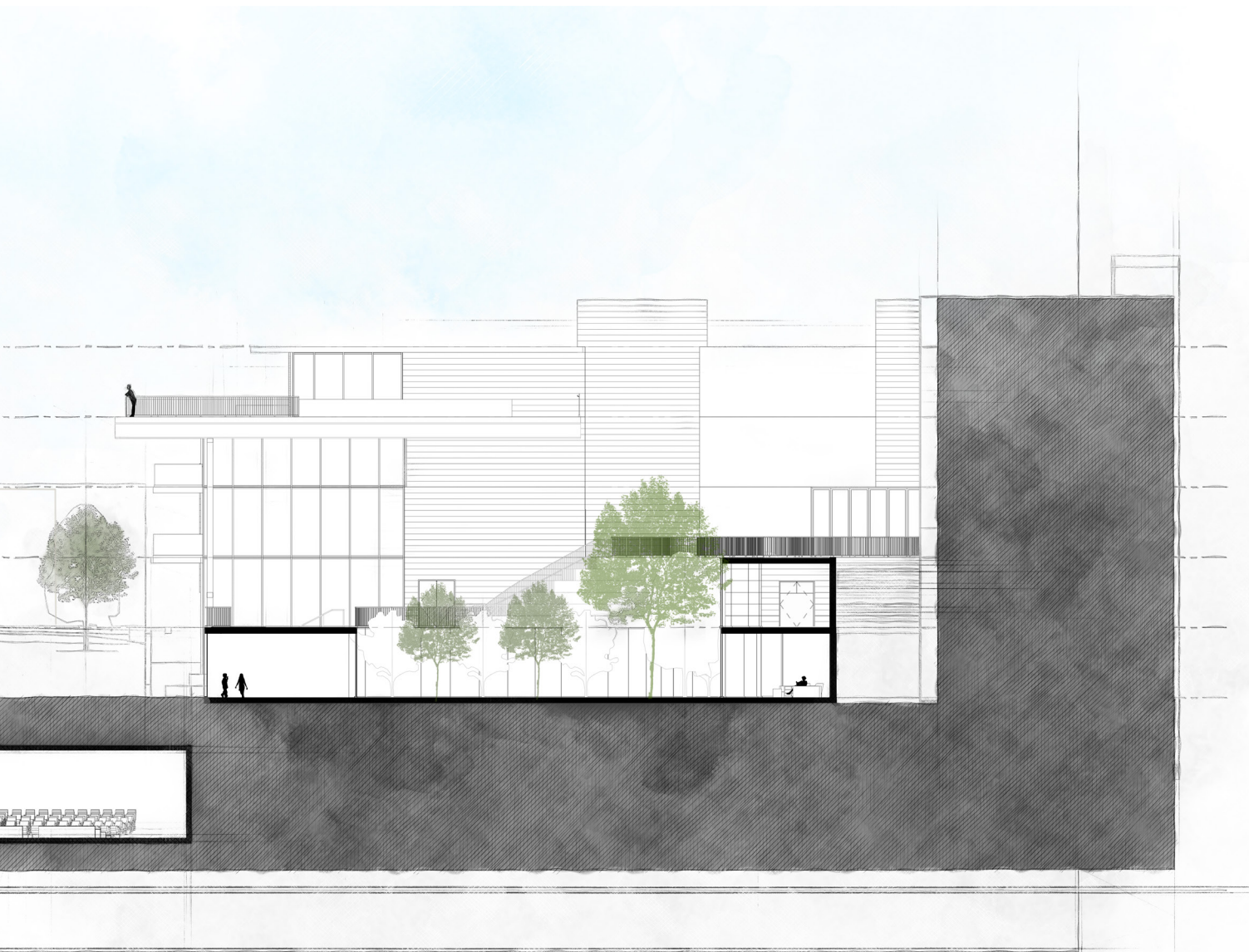


Fig. 59 - West site section



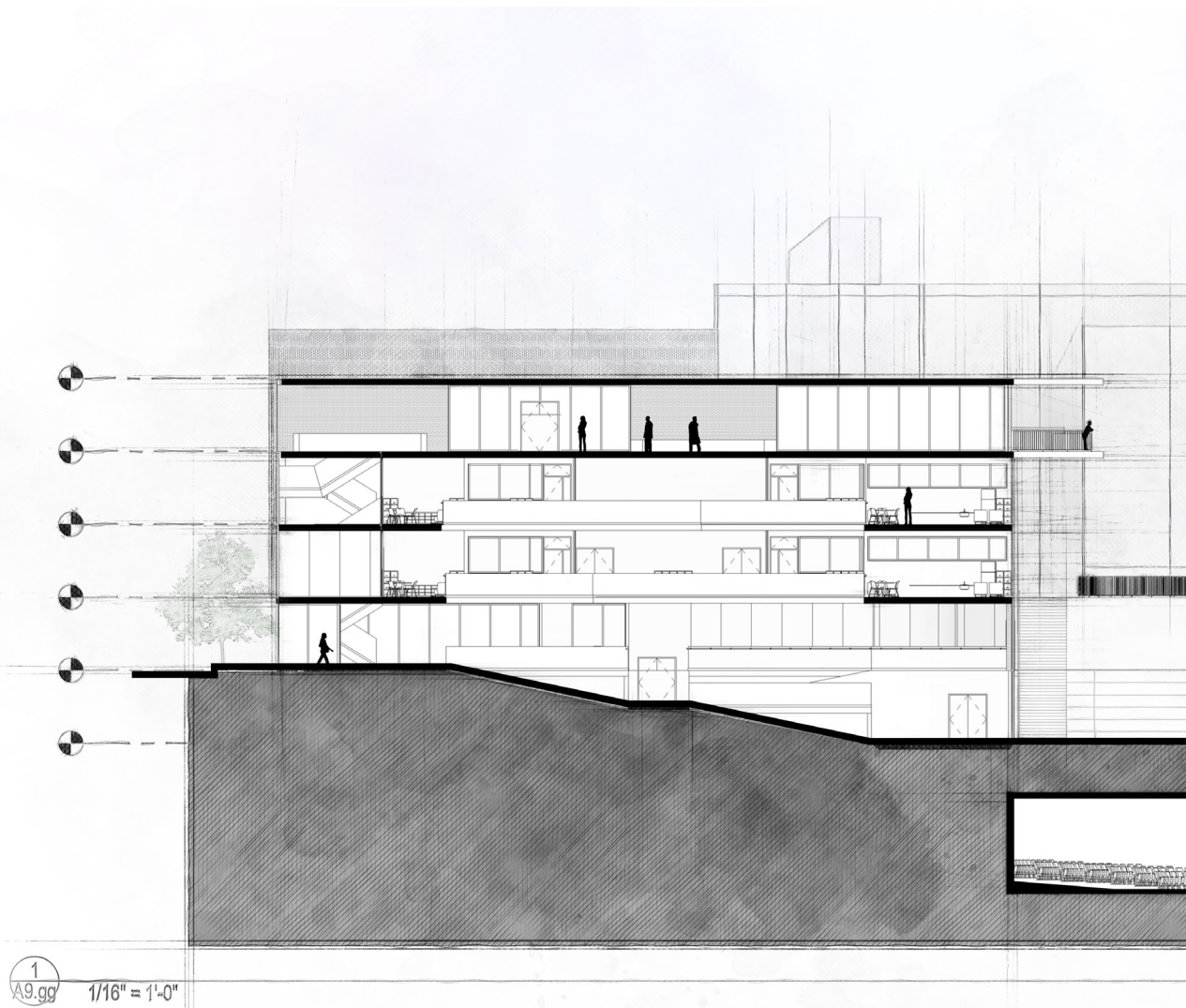
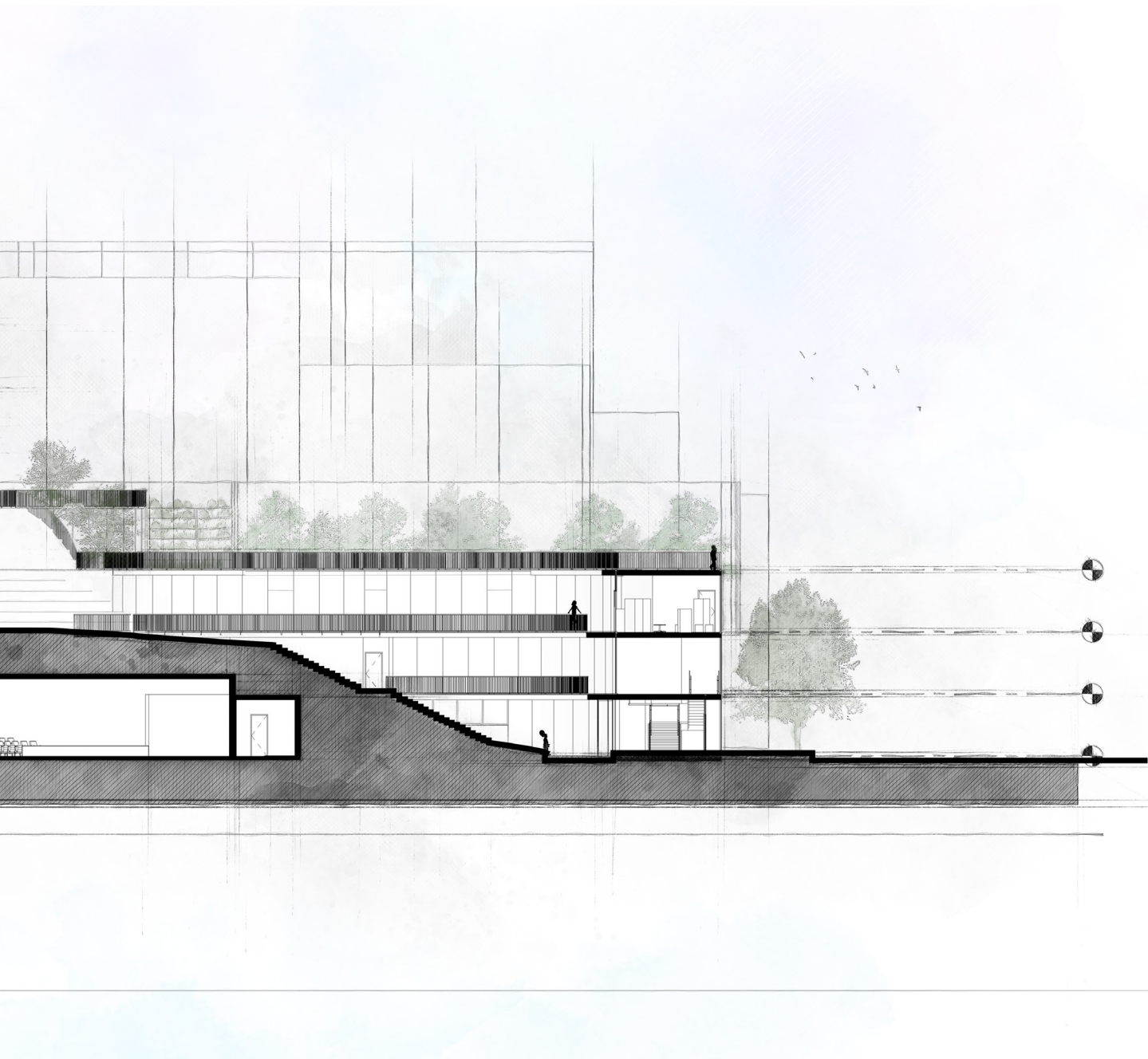


Fig. 60 - North site section



CHAPTER VIII

CONCLUSION: DEAF-FIRST ARCHITECTURE.

The exploration of this thesis began by listening to the feedback and desires of Deaf culture in an attempt to add something helpful to this body of knowledge. Architecture is unique in that it has the capacity to embody the values of a culture in a form that both effects and is effected by those who inhabit its space. Exploring how Deaf people have modified their space elicits profound implications that show the benefit of designing with the human experience at the forefront of design. By embodying a multi-sensory approach, our whole being is engrossed in the experience, rather than parsing and isolating the senses. If there is one thing I've learned from this body of research and design, it is that the loss of a sense isn't really a loss at all; we merely adapt, shift and look at the world through new eyes.

Moving beyond this project, the beginnings of seeing space through Deaf eyes provides profound implications for approaching architecture. Educational architecture particularly could benefit from

taking cues from how the deaf organize space. Indeed, some of the best practices in school design are just now catching up to where deaf schools have been for decades. Smaller scale classrooms, better visibility, better lighting and stronger connections assist in making higher quality and more enjoyable spaces for everyone. By designing schools for the deaf child first, school designers open the door to new opportunities that will make schools safer, more enjoyable and of higher quality. Deaf-first architecture is better architecture for all.

APPENDIX

PROGRAM

SEATTLE SCHOOL FOR THE DEAF, DEAF-BLIND AND HEARING

FTE = 400

DESCRIPTION				
NAME	QTY	SF/RM	TOTAL SF	Comments
INSTRUCTION				
ECPIP (Early Child Parent Intervention Program)	1	900	900	1300
ECPIP Classroom	1	400	400	
Pre-School w/ Toilet + Parent Observation Booth	1	1000	2000	2000
Kindergarten w/ Toilet	2	1000	2000	
k-1 Instruction	2	840	1680	
2-3 Instruction	2	840	1680	
4-5 Instruction	2	840	1680	
6-8 Instruction	4	900	3600	
6-8 Science Lab	1	1100	1100	
6-8 Dedicated Art Room	1	900	900	
Life Skills Classroom (Special Ed)	2	840	1680	
9-12 Instruction	4	900	3600	
9-12 Science Lab	2	1100	2200	
Total			23420	
NAME	QTY	SF/RM	TOTAL SF	
ENTRY LOBBY				

Entry lobby 1 5000

NAME	QTY	SF/RM	TOTAL SF
ADMIN			
~30 Teachers * 75sf			2250
Outreach Services (Offices)	4	150	600
Meeting Room	1	200	200

Total 3050

NAME	QTY	SF/RM	TOTAL SF
STUDENT DINING			
300 students * 14 sf			

Total 4200

NAME	QTY	SF/RM	TOTAL SF
GYM			

Average Gym Size (for regulation middle school competition) 6500

NAME	QTY	SF/RM	TOTAL SF
MULTI-PURPOSE			
Multi-Meeting Room	2	1200	2400
High-School Multi-Purpose Room	1	1200	1200

Total 3600

NAME	QTY	SF/RM	TOTAL SF
MECHANICAL RM			

Mechanical Room 9125 Adding 20% for circular
 Janitor
 Restrooms
 Misc

NAME	QTY	SF/RM	TOTAL SF
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Building SF Total: 65,895 sf

NAME	QTY	SF/RM	TOTAL SF
PLAY AREA			

Play Area 1 10000
 Green Area 1 10000

Total 75,775 sf

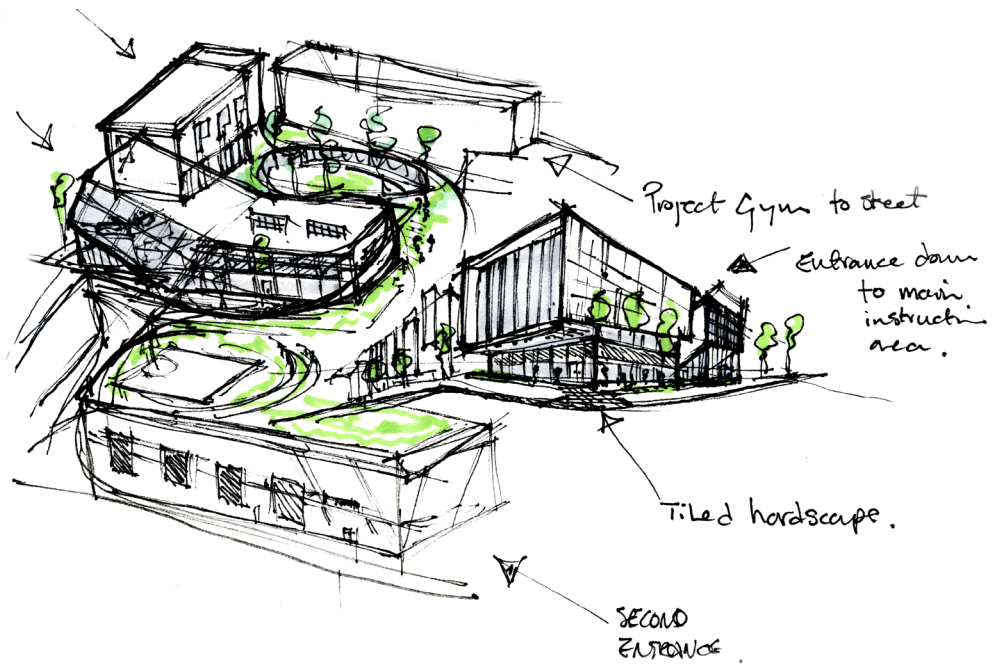


Fig. 61- Early concept sketch; blending building and landscape



Fig. 62 - Early concept sketch; projecting gym volume towards street

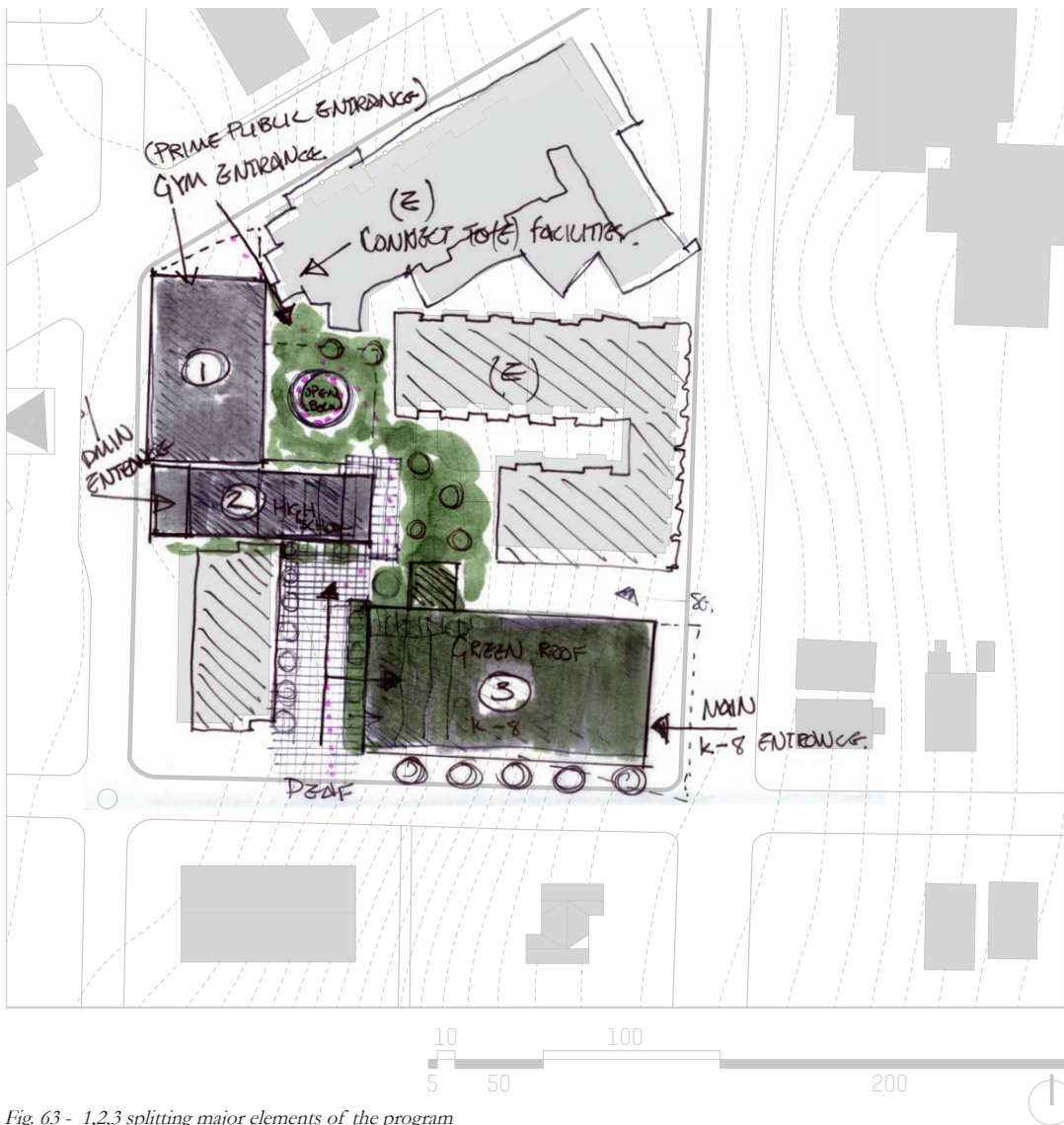


Fig. 63 - 1,2,3 splitting major elements of the program

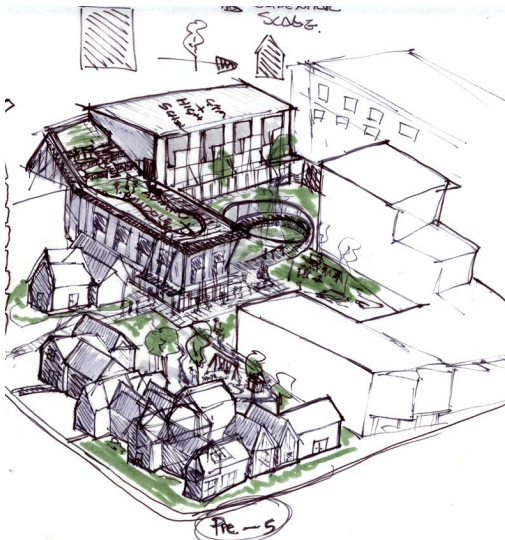


Fig. 64 - Breaking down the scale

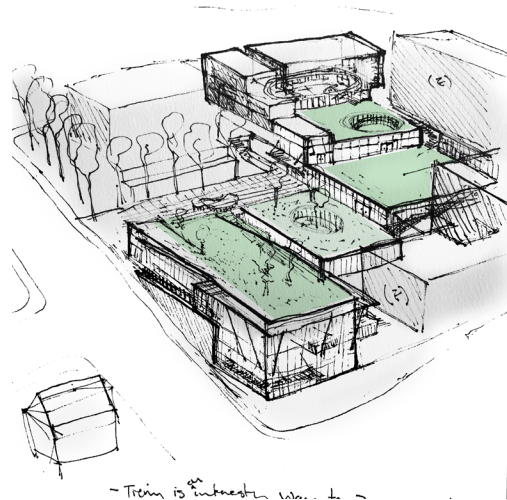


Fig. 64 - Zoning landscape elements

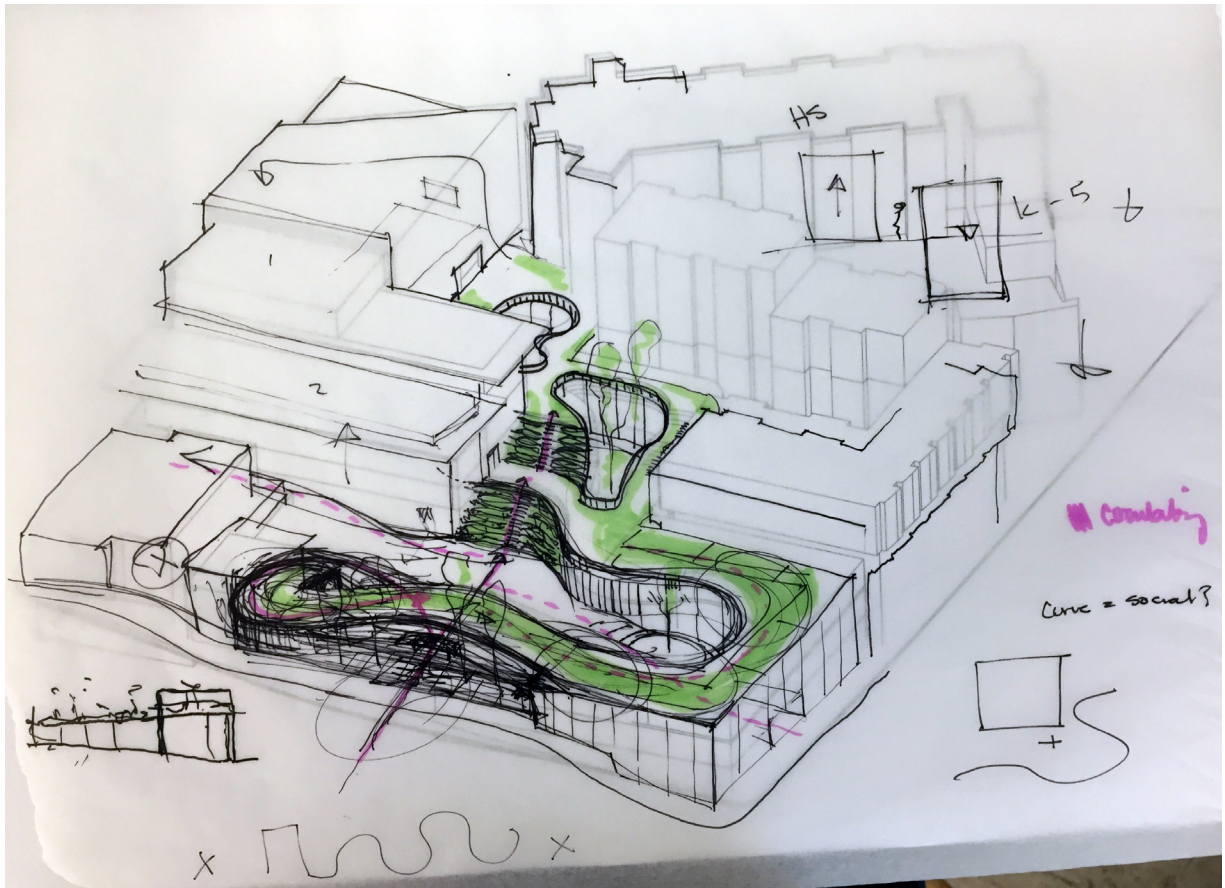


Fig. 65 - Deaf first + Deaf adapted space

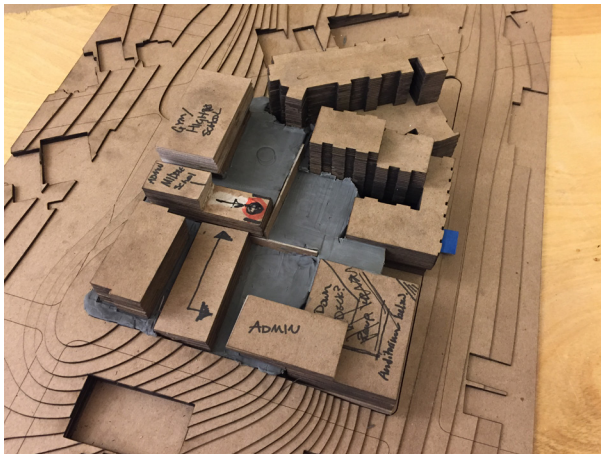


Fig. 66 - Working model of tiered building concept

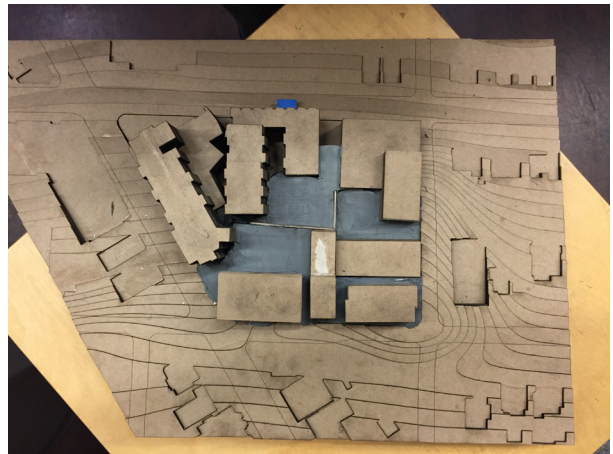


Fig. 67 - Working model of tiered building concept; plan

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